Assessment of Dam Safety
Coal Combustion Surface Impoundments (Task 3)
Draft Report

PacifiCorp
Naughton Power Station
Kemmerer, Wyoming

Prepared for

Lockheed Martin
2890 Woodridge Ave #209
Edison, New Jersey 08837

October 12, 2009

CHA Project No. 20085.2020.1510

CHA

I acknowledge that the management units referenced herein:

- FGD #1 Pond
- FGD #2 Pond
- North Ash Pond
- South Ash Pond

Have been assessed on September 9 and 10, 2009.

Signature: ____

Katherine E. Adnams, P.E.
Senior Geotechnical Engineer

Signature: ____

John P. Sobiech, P.E.
Partner
Registered Professional Engineer in the State of Wyoming

Reviewer: ____

Warren A. Harris, P.E.
Geotechnical Operations Manager

TABLE OF CONTENTS

SECTION **PAGE NUMBER**

TABLE OF CONTENTS - continued

SECTION **PAGE NUMBER**

TABLES

FIGURES

FIGURES - continued

APPENDIX

1.0 INTRODUCTION & PROJECT DESCRIPTION

1.1 Introduction

CHA was contracted by Lockheed Martin (a contractor to the United State Environmental Protection Agency) to perform site assessments of selected coal combustion surface impoundments (Project #0-381 Coal Combustion Surface Impoundments/Dam Safety Inspections). As part of this contract, CHA was assigned to perform a site assessment of PacifiCorp's Naughton Power Station, which is located in Kemmerer (Lincoln County), Wyoming as shown on Figure 1 – Project Location Map.

CHA made a site visit on September 9 and 10, 2009 to inventory coal combustion surface impoundments at the facility, to perform visual observations of the containment dikes, and to collect relevant information regarding the site assessment.

CHA engineers Katherine Adnams, P.E. and John Sobiech, P.E. were accompanied by the following individuals:

Company or Organization	**Name and Title**
US EPA	Joseph Byson
PacifiCorp Energy	Angeline Skinner, Managing Director
PacifiCorp Energy	Jeff Tucker, P.E., Principal Engineer
PacifiCorp Energy	Jason Murdock, Environmental Analyst
PacifiCorp Energy	Kent Laird, Engineer
PacifiCorp Energy	Callee Butcher, Environmental Analyst

1.2 Project Background

The Naughton Station has four primary impoundments; two impoundments that primarily receive flue gas desulfurization (FGD) byproducts, and two management units that primarily receive fly ash and bottom ash. The locations of these ponds are shown on Figure 2 and are identified as FGD #1 Pond, FGD #2 Pond, the North Ash Pond and the South Ash Pond. These impoundments are listed on the National Inventory of Dams (NID) with the following identification numbers:

Impoundment (Name on NID)	NID ID
FGD #1 Pond (FGD Evaporation Pond)	WY01643
FGD #2 Pond (Unit 3 FGD Pond 2)	WY02122
North Ash Pond (Unit 3 Ash and Clear Water)	WY01547
South Ash Pond (Units 1 and 2 Ash and Clear Water)	WY01546

The dikes for these impoundments are classified as follows by the State of Wyoming:

Impoundment	Wyoming Designated Hazard Classification
FGD #1 Pond	Not classified
FGD #2 Pond	Significant
North Ash Pond	Low
South Ash Pond	Low

These impoundments have been given a "significant" hazard rating, as shown on the EPA checklist included Appendix A, based on the potential for environmental damage in the event of a catastrophic failure of the impoundment dikes.

1.2.1 State Issued Permits

PacifiCorp has received the following state issued permits for the impoundments at the Naughton Power Station:

- **Wyoming Pollutant Discharge Elimination System** - Wyoming State Permit No. WY0020311 has been issued to PacifiCorp authorizing discharge under the USEPA National Pollutant Discharge Elimination System (NPDES) to the North Fork of Little Muddy Creek via an unnamed drainage in accordance with effluent limitations, monitoring requirements and other conditions set forth in the permit. The permit became effective on August 1, 2008 and will expire on July 31, 2013. (Note this permit covers all discharges from the Naughton Power Station site.)
- **Permit To Construct** – Permit #97-006 was issued by Wyoming DEQ to construct FGD #2 Pond.
- **Permit to Construct –** Permit #06-714 was issued by Wyoming DEQ to construct the pump back system to address seepage from FGD #2 Pond.

1.3 Site Description and Location

The Naughton Power Station is located to the southwest of Kemmerer, Wyoming. The plant operates three units with Unit 3 discharging to FGD #1 Pond, FGD #2 Pond, and the North Ash Pond. Units 1 and 2 discharge to the South Ash Pond. An air scrubber is currently under construction for Units 1 and 2.

The Naughton Power Station is located in a rural area, and the nearest downstream community is Granger, Wyoming, which is about 55 miles to the southeast. An aerial photograph of the region indicating the location of the Naughton Power Station is provided in Figure 3. As seen in this figure, there are no schools, hospitals, or other critical infrastructure located within five miles down gradient of the Naughton FGD and ash ponds.

1.3.1 FGD #1 Pond

The FGD #1 Pond is located to the north of the power plant. Figure 4A shows the nomenclature used in this report related to FGD #1 Pond. FGD #1 Pond has a surface area of approximately 40 acres and an approximate capacity of 1,038 acre-feet. Figure 4B shows a typical cross section of the FGD #1 Pond dike. Originally constructed in 1981, the FGD #1 dike was expanded in 1986, 1990, 1994, and most recently raised 11.5 feet in 2005. The FGD #1 has a maximum height of 36.5 feet. The pond is lined with a 30 mil PVC liner, and relies on evaporation to maintain the impounded water level while keeping at least 3 feet of freeboard. A diversion channel was constructed to the northeast of FGD #1 Pond to convey drainage from the upstream watershed around the impoundment.

1.3.2 FGD #2 Pond

The FGD #2 Pond is located to the northeast of the power plant. It has a surface area of approximately 40 acres and an approximate capacity of 671 acre-feet. Figure 5A shows the nomenclature used in this report to describe FGD #2 Pond and Figure 5B shows a typical cross section of the FGD #2 Pond dike. This pond was constructed in 1999. The FGD #2 Pond is impounded by dikes on most of 3 sides with a maximum height of 25 feet. The northwest portion of the pond is impounded by natural topography although a berm diverts drainage from the upstream watershed to the northeast of the pond. Built over a former drainage area called Culvert Draw, a diversion channel, connected to the upstream diversion channel from FGD #1 diverts stormwater runoff from the drainage basin to Cumberline Gulch.

The pond is lined with a 40 mil HDPE liner, and relies on evaporation to maintain the impounded water level while keeping at least 5 feet of freeboard.

1.3.3 North Ash Pond

The North Ash Pond is located to the northeast of the power plant. Originally commissioned in 1974, the North Ash Pond was expanded in 1982, 1987, and most recently modified to a two pond (ash settling and clearwater) system in 1994. Figure 6 shows the nomenclature used to describe the North Ash Pond complex. The ash pond portion of the complex has a surface area of 151.5 acres and an approximate storage capacity of 2,100 acre-feet. The clearwater portion of the complex has a surface area of 63 acres and an approximate storage capacity of 1,270 acre-feet.

There are two dikes associated with the North Ash Pond; the first separates the primary settling pond from the clear water pond (Intermediate Dike), while the second impounds the clear water pond (Main Dike). The maximum embankment height of the Intermediate Dike is 56 feet and the Main Dike is 52 feet. These dikes are constructed of compacted clay. Water levels are maintained through decant, drop inlet structures, and reuse of the clear water for sluicing ash from the plant.

A saddle berm (East Saddle Dike) is located immediately north of the east abutment of the Main Dike. The majority of this saddle dike provides freeboard and does not impound water.

Figure 7A shows a typical cross section of the Intermediate North Ash Dike, and Figure 7B shows a typical cross section of the main dike.

1.3.4 South Ash Pond

The South Ash Pond is located to the south of the power plant. Originally constructed in 1974, it was expanded in 1976, 1981, 1987 and most recently in 1994. There are two dikes associated with the South Ash Pond; the Intermediate Dike separates the primary settling pond from the clear water pond, while the Main Dike impounds south and east sides of the ash pond and clear water pond. Figure 6 shows the nomenclature used to describe the South Ash Pond complex.

The ash settling basin has a surface area of about 183 acres, with a storage capacity of 3,754 acre-feet. The clearwater pond has a surface area of 23 acres and an approximate capacity of about 303 acre-feet. The north and west sides of the South Ash Pond is impounded by natural topography. The maximum embankment height of the Main Dike is 71 feet. There is an approximately 3-foot difference in water level between the ash pond and the clearwater pond. These dikes are constructed of compacted clay. Water levels are maintained through decant drop inlet structures, and reuse of the clear water for sluicing ash from the plant.

Figure 8A shows a typical cross section of the Intermediate South Ash Dike, and Figure 8B shows a typical cross section of the Main South Ash Dike.

1.3.5 Other Impoundments

There are no other impoundments at the Naughton Power Station containing liquid borne coal combustion byproducts.

1.4 Previously Identified Safety Issues

There has not been any documented safety issues relating to unpermitted releases of CCW at the Naughton Power Station facility associated with dike failures. There have been, however, some seepage, issues in the past and PacifiCorp notes that deposited ash within the North and South Ash Ponds exceeds the permitted area for disposal at the upstream end of both the North and South Ash Ponds. The upstream areas are a discrepancy between a line drawn on the Permit Drawings submitted to the State of Wyoming and the actual elevation to which sluiced ash has accumulated. PacifiCorp indicated that they are working with the State of Wyoming DEQ to determine the best action to this situation. CHA is not considering this a release related to safety of the impoundments; rather it is a condition of their permit agreement with Wyoming DEQ.

In 2006, groundwater sampling wells indicated in 2006 that there was seepage emerging downstream of the FGD #2 Pond. The source of seepage was identified based on the differences in the natural groundwater chemistry and the chemistry of the groundwater samples which resembled the water chemistry from the FGD pond. A cut off trench was installed with a pump back system, which is still in operation. The approximate area of this pump back trench is shown on Figure 5A. PacifiCorp indicated the hypothesis was that a leak developed in the liner under already deposited FGD byproducts. Because of the composition of FGD byproducts which has a low permeability, PacifiCorp expects the liner to be "resealed" by the FGD byproducts as they are compressed by more deposited material. PacifiCorp indicated that they have already seen a significant decrease in the volume of water seeping into the pump back system since the system began operation.

1.5 Site Geology

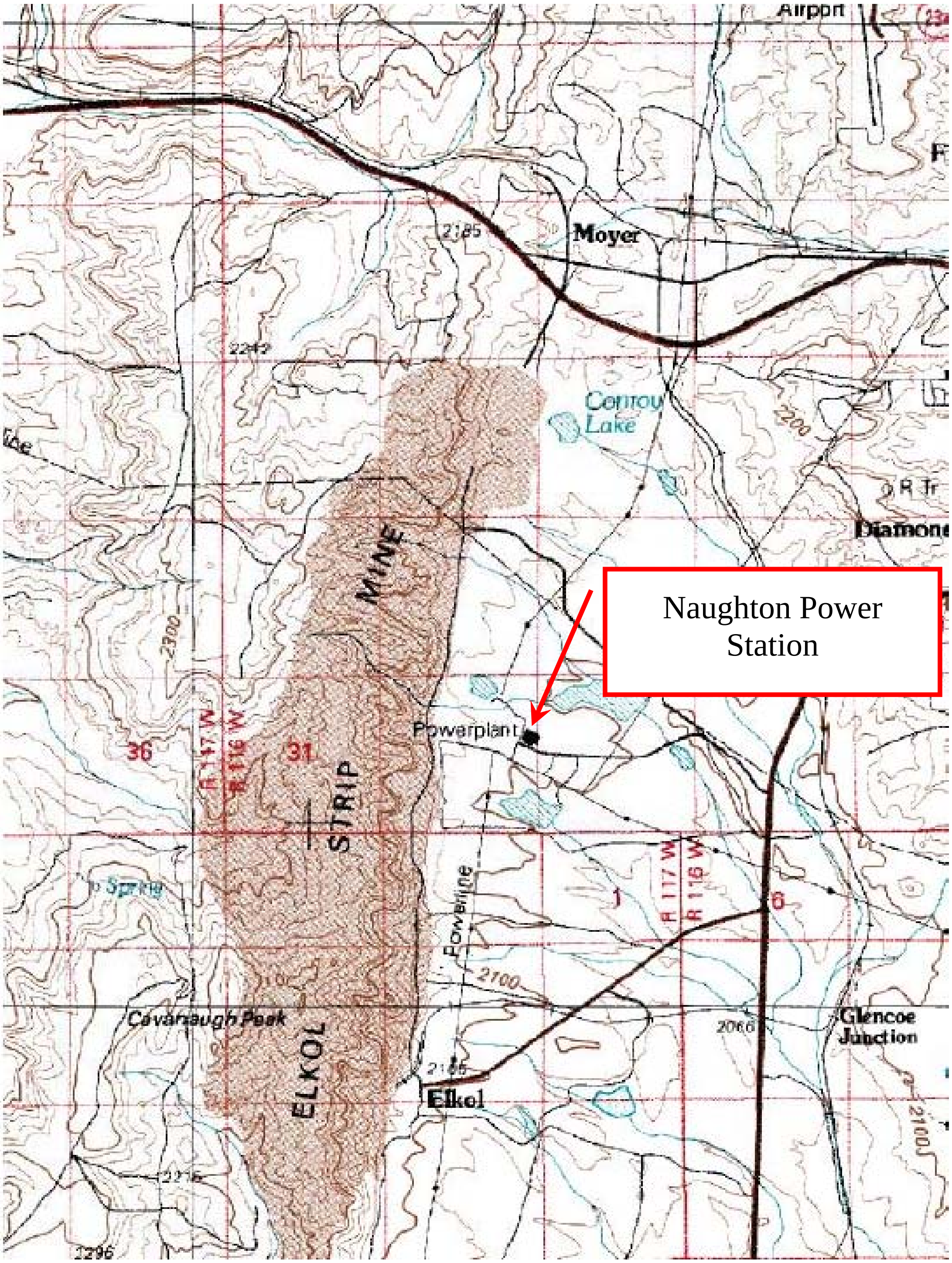
A review of *Surficial materials map of the Kemmerer 30' x 60' quadrangle, Lincoln, Uinta, and Sweetwater Counties, Wyoming: U.S. Geological Survey, Coal Investigations Map C-102, scale 1:100000,* by A. B. Gibbons (1986) suggests surficial geology at the Naughton Power Station includes alluvium side slopes, and fans within present and historic drainage courses consisting of silt, clay, sand and gravel that grades in an upslope direction into rock debris.

Bedrock at the site based on *Geologic map of the Kemmerer 30' X 60' quadrangle, Lincoln, Uinta, and Sweetwater Counties, Wyoming: U.S. Geological Survey, Miscellaneous Investigations Series Map I-2079, scale 1:100000* by J.W. M'Gonigle and J.H. Dover (1992) is expected to consist of dark olive-gray marine shale, siltstone, and sandy shale containing thin tan to light gray sandstone and limestone interbeds. This layer weathers into a fine grained residuum.

1.6 Bibliography

CHA reviewed the following documents provided by PacifiCorp in preparing this report:

- *Geotechnical Investigation and Design Report Prepared to Accompany Permit for Application for Combustion Waste Disposal Expansion Project*, March 1993, Black & Veatch.
- *Drawings to Accompany Application for Naughton Plant Combustion Waste Disposal Exansion Project, C-02 through C-16,* Black & Veatch.
- *Unit 3 FGD Pond 1 Modifications Design Report,* May 23, 2002, Maxim Technologies.
- *Unit 3 FGD Pond 1 Expansion, Sheets 2 of 7 through 7 of 7,* May 24, 2002, Maxim Technologies, Inc.
- *Unit 3 FGD Pond 2 Design Report and Drawings for Permit Application,* January 1998, Maxim Technologies.
- *Hydrologic Study Report*, March 1993, Black & Veatch.
- *Phase 1 Geotechnical Assessments*, *Coal Combustion Waste Pond Embankments*, April 20, 2009, Cornforth Consultants.



N

Figure 1
Project Location Map

Scale: 1" = 1 mile	**Project No.: 20085.2020.1510**	**PacifiCorp** **Naughton Power Station** **Kemmerer, Wyoming**

File: K:\20085\CADD\ACAD\FIGURES\GEO\2020 NAUGHTON\2020_PLANS-MAPS.DWG Saved: 10/12/2009 1:23:37 PM PLotted: 10/12/2009 2:14:48 PM User: Jensen, Andrew

IMAGE REFERENCE: GOOGLE EARTH, IMAGE DATE JULY 11, 2006

0 1570 3140
Scale in feet

N

Drawing Copyright © 2009

CHA

III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

PHOTO SITE PLAN

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085

DATE: 10/2009

FIGURE 2

IMAGE REFERENCE: GOOGLE EARTH, IMAGE DATE JULY 11, 2006

0 12,465 24,930
Scale in feet

N

Page 11

CHA

III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

CRITICAL INFRASTRUCTURE MAP

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085

DATE: 10/2009

FIGURE 3

File: K:\20085\CADD\ACAD\FIGURES\GEO\2020 NAUGHTON\2020_PLANS-MAPS.DWG Saved: 10/12/2009 1:23:37 PM PLotted: 10/12/2009 2:15:09 PM User: Jensen, Andrew

IMAGE REFERENCE: GOOGLE EARTH, IMAGE DATE JULY 11, 2006

0 785 1570
Scale in feet

Drawing Copyright © 2009
CHA
III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

PHOTO SITE PLAN FGD #1 POND

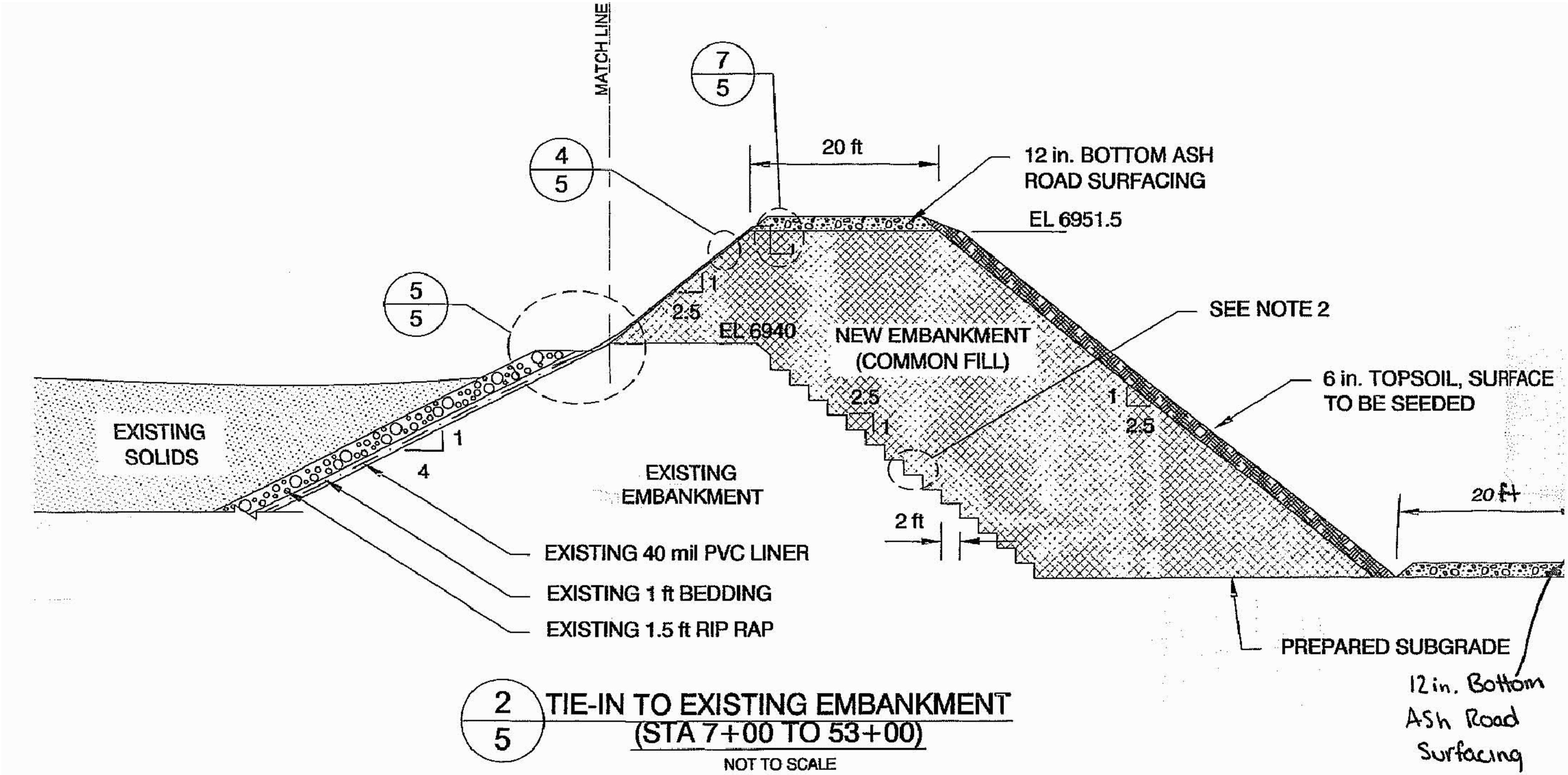
NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085

DATE: 10/2009

FIGURE 4A

File: K:\20085\CADD\ACAD\FIGURES\GEO\2020 NAUGHTON\2020_PLANS-MAPS.DWG Saved: 10/12/2009 1:23:37 PM Plotted: 10/12/2009 2:15:28 PM User: Jensen, Andrew



2
5
TIE-IN TO EXISTING EMBANKMENT
(STA 7+00 TO 53+00)
NOT TO SCALE

IMAGE REFERENCE:

0 1160 2320
Scale in feet

CHA
III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

FGD #1 POND
TYPICAL CROSS SECTION

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085.2020	
DATE: 10/2009	
FIGURE 4B	

File: K:\20085\CADD\ACAD\FIGURES\GEO\2020 NAUGHTON\2020_XSECTIONS.DWG Saved: 10/12/2009 2:21:09 PM Plotted: 10/12/2009 4:13:08 PM User: Jensen, Andrew

IMAGE REFERENCE: GOOGLE EARTH, IMAGE DATE JULY 11, 2006

0 785 1570
Scale in feet

Drawing Copyright © 2009
CHA
III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

PHOTO SITE PLAN FGD #2 POND

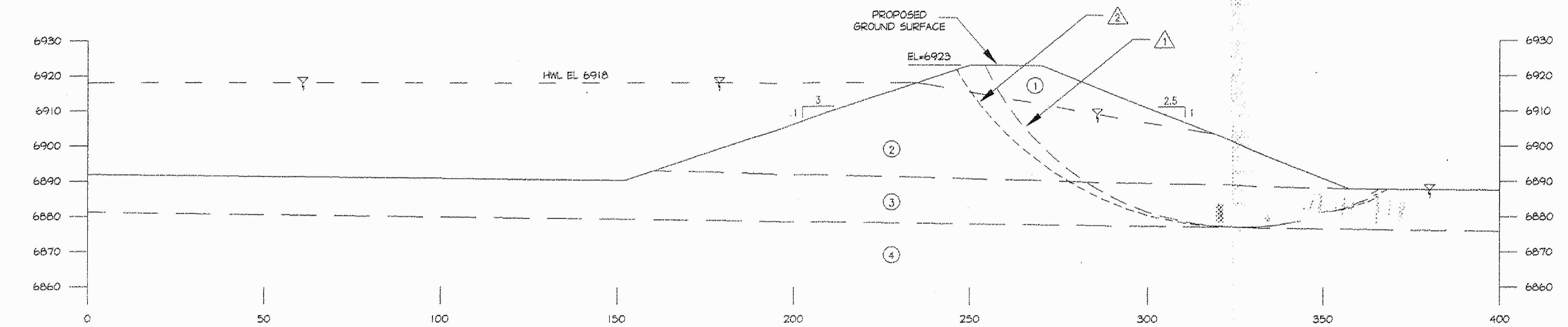
NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085

DATE: 10/2009

FIGURE 5A

File: K:\20085\CADD\ACAD\FIGURES\GEO\2020 NAUGHTON\2020_PLANS-MAPS.DWG Saved: 10/12/2009 1:23:37 PM Plotted: 10/12/2009 2:15:49 PM User: Jensen, Andrew



SOIL LAYER	WET UNIT WEIGHT (pcf)	COHESION (psf)	FRICTION ANGLE (°)
1 FILL ABOVE GWL	122.0	600	26
2 FILL BELOW GWL	122.0	600	26
3 LEAN CLAY	119.5	200	25
4 CLAYSTONE BEDROCK	130.2	4000	0

CASE		1	2
CONDITIONS		STATIC	PSEUDO-STATIC
MINIMUM FACTOR OF SAFETY		1.5	1.1
REQUIRED FACTOR OF SAFETY		1.5	1.0
RADIUS		79 ft	92 ft
CENTER	HOR. POINT	326	325
	VERT. POINT	6956	6969
SEISMIC COEFFICIENT		0.00 g	0.10 g

IMAGE REFERENCE: SLOPE STABILITY ANALYSIS STEADY STATE SEEPAGE WITH MAXIMUM STORAGE POOL, NAUGHTON PLANT UNIT 3, FGD POND 2, SHEET C-2, MAXIM TECHNOLOGIES, INC., 10-10-96

CHA

III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

FGD #2 POND
TYPICAL CROSS SECTION AND
STABILITY ANALYSES

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO.
20085.2020

DATE: 10/2009

FIGURE 5B

File: K:\20085\CADD\ACAD\FIGURES\GEO\2020 NAUGHTON\2020_XSECTIONS.DWG Saved: 10/12/2009 2:21:09 PM Plotted: 10/12/2009 4:11:47 PM User: Jensen, Andrew

IMAGE REFERENCE: GOOGLE EARTH, IMAGE DATE JULY 11, 2006

Drawing Copyright © 2009

CHA

III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

PHOTO SITE PLAN NORTH AND SOUTH ASH PONDS NOMENCLATURE

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085

DATE: 10/2009

FIGURE 6

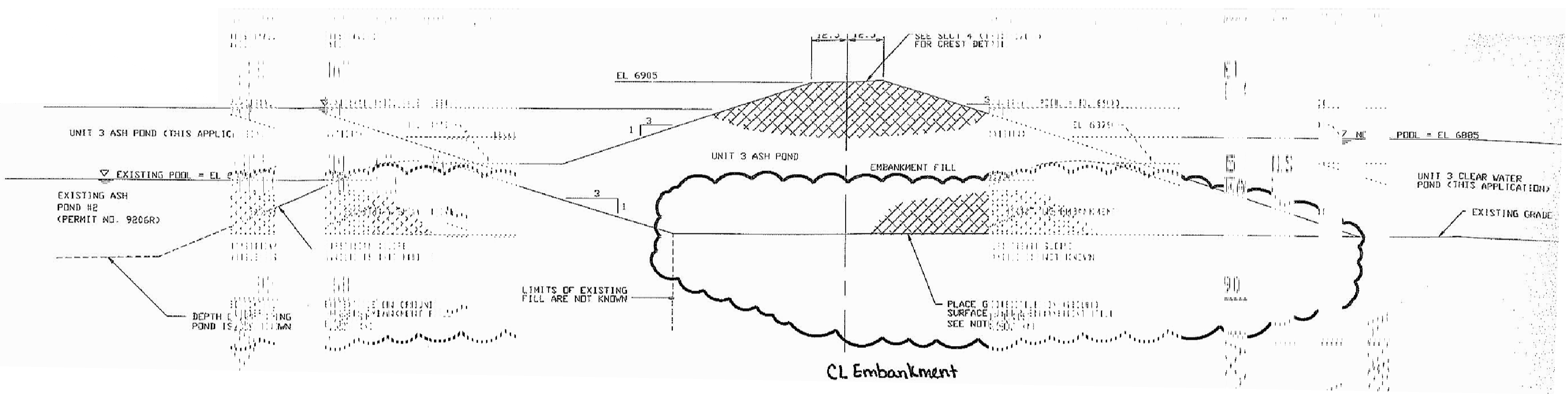


IMAGE REFERENCE: DRAWING TO ACCOMPANY APPLICATION FOR:
PACIFICORP NAUGHTON PLANT COMBUSTION WASTE DISPOSAL EXPANSION
PROJECT C-13 BY BLACK & VEATCH

CHA
III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

TYPICAL CROSS SECTION NORTH ASH POND INTERMEDIATE DIKE

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085.2020

DATE: 10/2009

FIGURE 7A

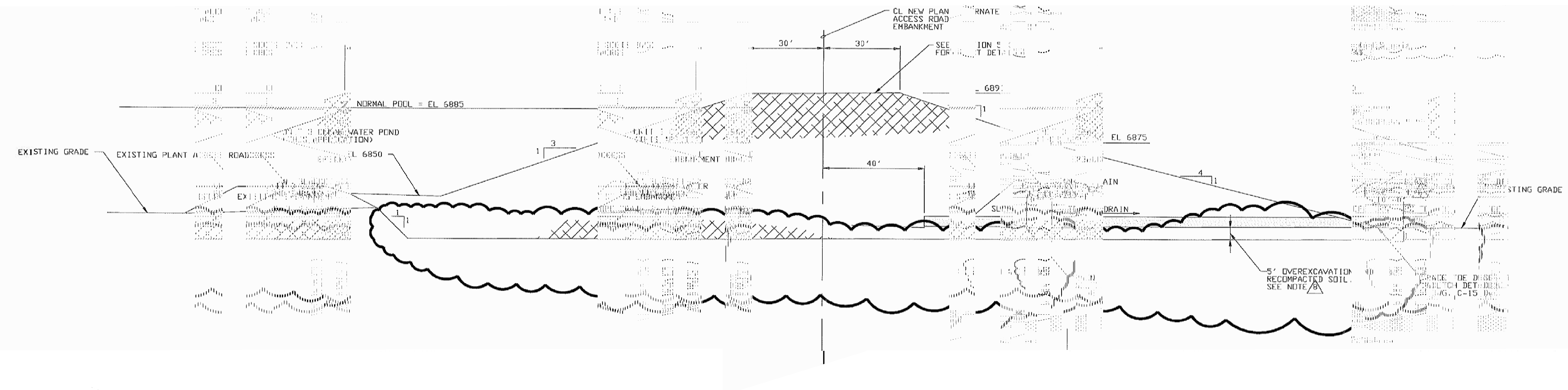


IMAGE REFERENCE: DRAWING TO ACCOMPANY APPLICATION FOR:
PACIFICORP NAUGHTON PLANT COMBUSTION WASTE DISPOSAL EXPANSION
PROJECT C-13 BY BLACK & VEATCH

CHA

III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

TYPICAL CROSS SECTION NORTH ASH POND MAIN DIKE

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085.2020

DATE: 10/2009

FIGURE 7B

File: K:\20085\CADD\ACAD\FIGURES\GEO\2020 NAUGHTON\2020_XSECTIONS.DWG Saved: 10/12/2009 2:21:09 PM Plotted: 10/12/2009 4:04:38 PM User: Jensen, Andrew

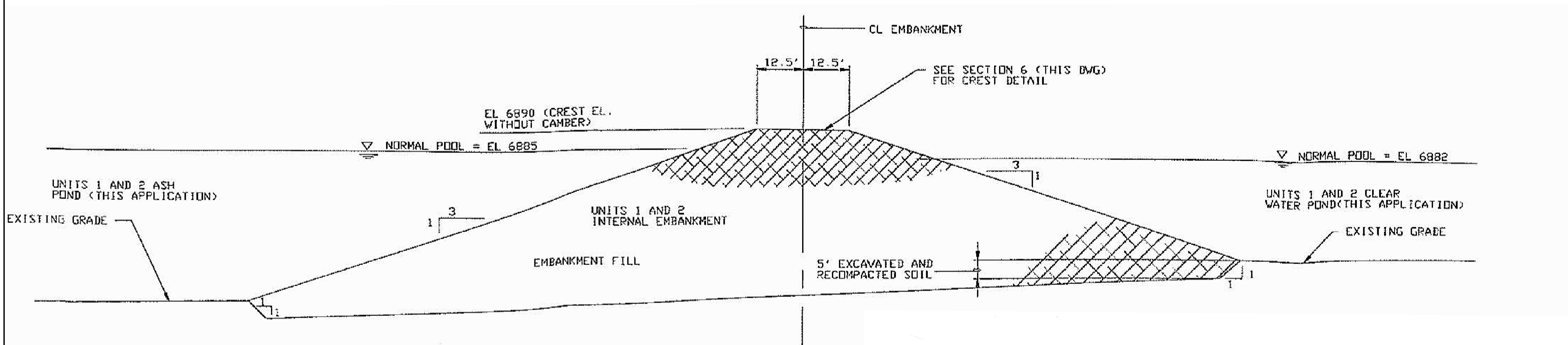


IMAGE REFERENCE: DRAWING TO ACCOMPANY APPLICATION FOR:
PACIFICORP NAUGHTON PLANT COMBUSTION WASTE DISPOSAL EXPANSION
PROJECT C-13 BY BLACK & VEATCH

CHA
III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

TYPICAL CROSS SECTION SOUTH ASH POND INTERMEDIATE DIKE

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085.2020

DATE: 10/2009

FIGURE 8A

File: K:\20085\CADD\ACAD\FIGURES\GEO\2020 NAUGHTON\2020_XSECTIONS.DWG Saved: 10/12/2009 2:21:09 PM Plotted: 10/12/2009 4:02:12 PM User: Jensen, Andrew

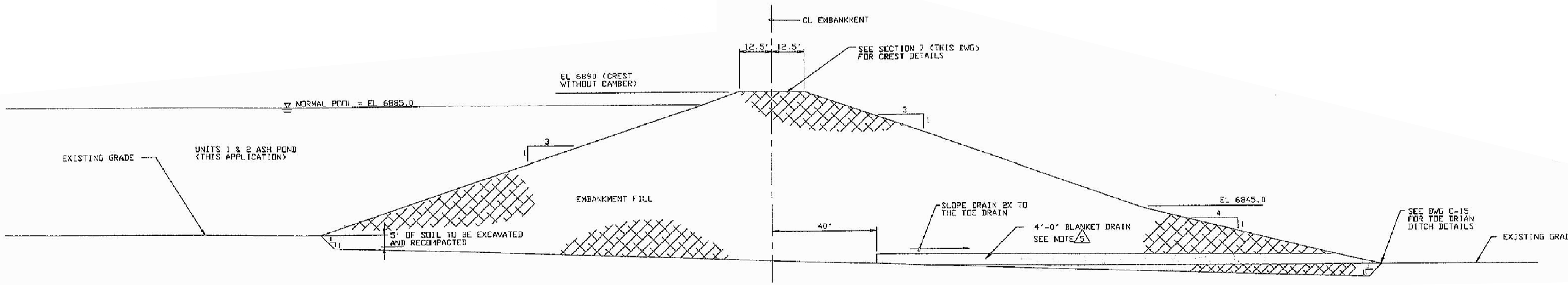


IMAGE REFERENCE: DRAWING TO ACCOMPANY APPLICATION FOR:
PACIFICORP NAUGHTON PLANT COMBUSTION WASTE DISPOSAL EXPANSION
PROJECT C-12 BY BLACK & VEATCH

CHA
III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

TYPICAL CROSS SECTION SOUTH ASH POND MAIN DIKE

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085.2020

DATE: 10/2009

FIGURE 8B

2.0 FIELD ASSESSMENT

2.1 Visual Observations

CHA performed visual observations of FGD #1 Pond, FGD #2 Pond, the North Ash Pond and the South Ash Pond following the general procedures and considerations contained in Federal Emergency Management Agency's (FEMA's) *Federal Guidelines for Dam Safety* (April 2004), and Federal Energy Regulatory Commission (FERC) Part 12 Subpart D to make observations concerning settlement, movement, erosion, seepage, leakage, cracking, and deterioration. A Coal Combustion Dam Inspection Checklist and Coal Combustion Waste (CCW) Impoundment Inspection Form, prepared by the US Environmental Protection Agency, were completed on-site for each impoundment during the site visit. Copies of the completed forms were submitted via email to a Lockheed Martin representative approximately three days following the site visit to the Naughton Power Station. Copies of these completed forms are included in Appendix A. A photo log and Site Photo Location Maps (Figures 9A, 9B and 9C) for the Naughton impoundments are also located at the end of Section 2.6.

CHA's visual observations were made on September 9, and 10, 2009. The weather was sunny with temperatures between 35 and 80 degrees Fahrenheit.

2.2 FGD #1 Pond

CHA performed visual observations of the FGD #1 Pond dike, which completely encircles the impoundment. The dike is in total about 5,500 feet long with a maximum height of 36.5 feet. The FGD #1 Pond was raised by 11.5 feet in 2005. The upstream slopes are lined with a PVC liner, the crest is graded for access road use with bottom ash, and the downstream slopes are vegetated with crescent wheat and sage; a mix provided by WYDEQ.

2.2.1 Embankments and Crest

In general the alignment of the encircling dike crest appears to match the design drawings reviewed for this project. There is an access road that runs the entire length of the dike crest. In some areas, re-grading of this access road has lead to over steepening of the top of the downstream slope as shown in Photo 4. Photos 2, 15, 20, and 25 show the general conditions of the crest around the FGD #1 Pond.

The upstream slope is covered with a 30 mil PVC liner as shown in Photos 1, and 18. A couple of depressions were noted on the upstream slope/crest intersection at the north end of the northeast dike as shown in Photo 3. PacifiCorp representatives indicated this was an area where sluice lines had formerly been laid, and that some frost heaving issues had occurred. The access road on the crest was re-graded, but the resulting depressions at the top of the upstream slope were not repaired.

The downstream slope is vegetated primarily with crested wheatgrass. Photos 6, 8, 17, and 29 show the general conditions of the vegetation. As these photos show, the vegetation is very sparse in some areas, with apparent growth hampered by prevailing direction the slopes face. Occasional erosion rills were noted, such as that shown in Photo 5. A series of animal burrows were observed near the north end of the northeast dike as shown in Photo 9. In general the slopes appear fairly uniform, and did not exhibit signs of movement.

Near the mid point of the northeast dike, a crack, about 65 feet long was observed about 12 feet below the crest elevation. This crack was generally parallel to the slope and could be penetrated with a rebar probe up to about 2 feet in some areas. Photos 10 and 11 show the area and appearance of this crack.

At the south end of the west dike, guy wires from adjacent power poles are anchored within the footprint of the dike. The dike was constructed around the guy wires with special backfilling details included in the construction drawings. These guy wires are shown in Photo 28.

2.2.2 FGD #1 Pond Outlet Control Structure

The FGD #1 Pond was designed to be an evaporation pond. Therefore, there is no outlet control structure or discharge channel. A freeboard of 3 feet is maintained to allow for design storm storage. Because this impoundment is fully diked, the only inflow to the pond during the design storm is that which falls on the surface of the pond, the crest and upstream slope (the crest generally is flat to graded toward the pond.

2.3 FGD #2 Pond

CHA performed visual observations of the FGD #2 Pond. The FGD #2 Pond dikes are about 3,500 feet long with a maximum height of about 25 feet. The upstream slopes are lined with an HDPE liner, the crest is graded for access road use with bottom ash, and the downstream slopes are vegetated with crested wheatgrass and sage; a mix provided by WYDEQ. The FGD #2 Pond is diked from about the mid point of the south side around the east and north sides of the pond to where the pond side runs roughly northeast/southwest.

2.3.1 Embankments and Crest

The crest alignment of the FGD #2 Pond dikes do not appear changed from historic site plans. The upstream slope is covered with an HDPE liner as shown in Photo 33. PacifiCorp makes routine inspections of the exposed portions of the liner and makes repairs as needed whether breaches of the liner occur from animal traffic, such as shown in Photo 36 or splits in seams as shown in Photo 49. In 2006 seepage observed downstream of the south corner of the dike was determined to be coming from FGD #2 pond through a leak in the liner by evaluating the water chemistry. The leak was hypothesized to be below the FGD byproducts and therefore, deemed impractical to repair. To contain this seepage on site, a cutoff/seepage collection trench of crushed stone lined on the downstream side with a geomembrane was installed. Seepage water is collected in this trench and then pumped back to the FGD #2 Pond. PacifiCorp expects compressing/settling FGD byproducts to have a decreasing permeability and personnel accompanying CHA in the field indicated a reduction in pump back volume has occurred since the installation of the system. The area of the pump back system and original seepage is seen in Photo 37.

The downstream slopes are vegetated primarily with crested wheatgrass, although occasional sage bushes (Photo 43) are present. Photos 34, 40, and 42 show the general conditions of the vegetation. As these photos show, the vegetation is very sparse in some areas, with apparent growth hampered by prevailing direction the slopes face. Occasional erosion rills were noted, such as that shown in Photo 18. Numerous animal burrows were observed along the downstream slopes. Photos 41, 42, 44, and 46 show the ranges of sizes of these animal burrows. In general the slopes appear fairly uniform, and did not exhibit signs of movement.

2.3.2 FGD #2 Pond Outlet Control Structure

The FGD #2 Pond was designed to be an evaporation pond. Therefore, there is no outlet control structure or discharge channel. A freeboard of 5 feet is maintained to allow for design storm storage. The northwest area of FGD #2 Pond is impounded by natural topography. A berm and diversion ditch prevents stormwater run off from the upstream drainage area from entering the pond. Therefore, the only inflow to the pond during the design storm is that which falls on the surface of the pond, the crest and upstream slope. The crest generally is flat to graded toward the pond.

2.4 North Ash Pond

The North Ash Pond is comprised of a primary basin into which coal combustion byproducts (CCB) is sluiced, and a clearwater basin separated from the primary basin by an intermediate dike. The main dike, over which the access road to the plant runs, contains the downstream end of this complex. A saddle dike (East Saddle Dike) is present on the east side of the clearwater pond.

CHA performed visual observations of the North Ash Pond Dikes. The intermediate dike is about 3,200 feet long and about 56 feet high. The main dike is about 2,400 feet long and about 52 feet high. The saddle dike is about 850 feet long and about 10 feet high.

2.4.1 Embankments and Crest

The crest alignments of the North Ash Pond Intermediate and Main dikes do not appear changed from historic site plans. Photos 51 and 52 show typical conditions of the Intermediate Dike Crest. Photo 72 shows the crest of the Main Dike. The access road to the Naughton Power Station crosses the Main Dike. Therefore the crest is about 60 feet wide. The crest of the East Saddle Dike is shown in Photo 88.

2.4.1.1 Embankments and Crest – Intermediate Dike

The upstream slope of the Intermediate Dike is covered in rip rap as shown in Photo 60 and 61. This slope is uniform and well maintained although occasional shrubs were observed growing through the rip rap. The downstream slope is vegetated with crested wheatgrass. Isolated sage bushes were observed as shown in Photo 64. Where the downstream slope is adjacent to the clearwater pond, rip rap protection armors the lower portion of the slope as shown in Photo 56. Away from the Clearwater pond the slope is fully vegetation as shown in Photo 66.

Animal burrows were observed in several locations on the downstream slope of the intermediate dike such as shown in Photos 58 and 68. Near the northeast corner of the Intermediate Dike, a crack was observed adjacent to an animal burrow as shown in Photo 65. The crack appeared to be related to the grading of the access road material.

At the north end of the Intermediate Dike, a wetland area has developed between the Intermediate Dike and the pump back system for FGD #2 Pond. While this area was wet, the toe of the Intermediate Dike and adjacent ground was firm when probed with a piece of rebar. Photos 67 and 69 show this wetland area.

2.4.1.2 Embankments and Crest – Main Dike

The majority of the Main Dike crest is paved with the plant access road. To either side (up and downstream) of the access road, a portion of crest is vegetated with grass between the guardrails and the slopes of the dike. The upstream slope of the Main Dike is covered with rip rap as shown in Photo 72. Photo 70 shows the downstream slope of the Main Dike which is covered with crested wheatgrass. In general the slopes of the embankment were uniform.

An area of differential movement in the crest has been observed adjacent to (but not directly over) the outlet pipe. CHA observed this area, but it did not look as severe as shown in photos taken by Cornforth Consultants in February of 2009. This suggests some of the differential movement may be frost heave related.

Seepage has been observed and studied in the past in the area of the east groin of the Main Dike. Photo 71 shows the groin with protective rip rap. Studies by Cornforth Consultants suggest that the observed seepage is from groundwater running along near surface bedrock. Sloughing has been observed in the natural ground beyond the Main Dike, but has not impacted the integrity of the Main Dike.

Occasional erosion rills, animal burrows, and sage bushes were observed on the downstream slope of the Main Dike. These types of features are shown in Photos 73, 79, and 82. The downstream toe contains a blanket drain that daylights at the toe. This lower area of the embankment is protected with small rip rap.

2.4.1.3 Embankments and Crest – East Saddle Dike

The East Saddle Dike does not fully impound water but provides freeboard storage. The upstream slope of the East Saddle Dike is covered with rip rap as shown in Photos 84 and 90. The crest and downstream slope are covered in crested wheatgrass as shown in Photos 85 and 88. An intermittent, but somewhat continuous, linear crack was observed at the crest/downstream slope intersection as shown in Photos 86 and 87.

2.4.2 North Ash Pond Outlet Control Structure and Discharge Channel

There are two discharge structures associated with the North Ash Pond complex. The first is a decant structure that discharges water from the primary basin into the clearwater basin, which is shown in Photos 59, and 62. The discharge end of the outlet pipe into the clearwater basin is shown in Photo 63. The discharge area is protected with rip rap.

The second discharge is a drop inlet in the clearwater basin, which is located near the west end of the Main Dike. Photo 76 shows this discharge end of this second outlet control structure. The outflow discharges through a v-notch weir into a rip rap lined channel. During our site visit, the discharge was not filling the weir box to the bottom of the weir and was seeping out between the bottom and end plates of the weir box.

A rip rap lined discharge channel parallels the toe of the embankment as shown in Photos 77 and 78. Near the mid-point of the Dike, the discharge channel rejoins the original drainage feature across which the Main Dike was constructed. A V-notch weir was observed in the downstream channel, but flow has eroded around the weir and is no longer going through the weir. It is unclear why this weir structure is in place, which is shown in Photos 80 and 81.

2.5 South Ash Pond

CHA performed visual observations of the South Ash Pond. The South Ash Pond dike is about 6,260 feet long and with a maximum height of 71 feet. The South Ash Pond is comprised of a primary basin into which CCW is sluiced, and a clearwater basin separated from the primary basin by an intermediate dike. The elevation difference between the primary basin and the clearwater basin water surfaces was about 3 feet at the time of our site visit.

2.5.1 Embankments and Crest

The crest alignment of the South Ash Pond dike does not appear changed from historic site plans. The crest is graded with an access road, the downstream slope is vegetated with crested wheatgrass and the upstream slope is covered with large rip rap. The downstream slopes appeared uniform and did not show signs of movement. Photos 94, 107, 115, and 123 show typical vegetation conditions on the downstream slope. As the photos show, the vegetation is more sparse in some areas than in others. In some locations sage bushes were established as can be seen in Photos 105, 108, and 118. The rip rap slopes were uniform and in good condition as shown in Photos 111, and 122, and was submerged below the water level as shown in Photo 128 protecting the upstream slope from wave erosion.

Seepage areas were noted along the toe of the east dike near the intersection with the northeast dike and along the eastern portion of the south dike. In these areas, there was water at the ground surface, and the vegetation was different, which is indicative of constant seepage. The ground was firm and the seepage appeared to be clear. PacifiCorp had previously identified these areas as seepage and had discussed them with CHA in the kickoff meeting. Photos 111 and 118 show this condition. Additional possible seepage areas were noted immediately northwest of the outlet control structure, and southeast of the area where the discharge channel veers away from the dike. These areas are discussed in Section 2.5.2 below.

Occasional animal burrows were observed as shown in Photos 104, 112, 117 and 125. Occasional erosion rills were also observed as shown in Photo 124.

2.5.2 South Ash Pond Outlet Control Structures

There are two discharge structures associated with the South Ash Pond complex. The first is a decant structure that discharges water from the primary basin into the clearwater basin, which is shown in Photos 127, and 129. The discharge end of the outlet pipe into the clearwater basin was submerged.

The second discharge is a drop inlet in the clearwater basin. Photos 102 and 103 show this second outlet control structure. The floating access platform to the upstream end of this structure is collapsed. Photos 96, and 97 show the discharge structure and outflow as it was observed during our site visit. The outflow discharges through a V-notch weir into a rip rap lined channel. The discharge channel is rip rap lined as shown in Photos 99 and 101. The discharge channel parallels the toe of the northeast dike for about 325 feet prior to turning to the east away from the dike as shown in Photo 106.

Standing water was observed “upstream” of the discharge structure as shown in Photo 95 and 100. Plant personnel indicated that this is likely water that accumulates when the outlet is flowing at a higher volume than it was on the day of our site visit, and then because of the grading along the toe, the water ponds in this area. CHA did not observe signs that this standing water would be seepage, and the water was clear.

Another area where water from the discharge channel or from seepage may be affecting the type of vegetation growing was to the southeast of where the discharge channel veers away from the northeast dike. This area is shown in Photo 106. CHA was unable to determine if this area receives overflow from the discharge channel or if there is seepage. The embankment and ground beyond were firm.

2.6 Monitoring Instrumentation

There is no active instrumentation monitoring of the dikes at the Naughton Power Station.

IMAGE REFERENCE: GOOGLE EARTH, IMAGE DATE
JULY 11, 2006

N

CHA

III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

SITE PHOTO LOCATION MAP FOR
FGD #1 & #2 PONDS

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO.
20085

DATE: 10/2009

FIGURE 9A

IMAGE REFERENCE: GOOGLE EARTH, IMAGE DATE
JULY 11, 2006

CHA
III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

SITE PHOTO LOCATION MAP FOR
NORTH ASH POND

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO.
20085

DATE: 10/2009

FIGURE 9B

IMAGE REFERENCE: GOOGLE EARTH, IMAGE DATE JULY 11, 2006

CHA

III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

SITE PHOTO LOCATION MAP FOR SOUTH ASH POND

NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085

DATE: 10/2009

FIGURE 9C

File: K:\20085\CADD\ACAD\FIGURES\GEO\2020 NAUGHTON\2020_PHOTO_LOCS.DWG Saved: 10/12/2009 3:55:17 PM Plotted: 10/12/2009 3:55:49 PM User: Jensen, Andrew

1

Upstream slope of northeast dike looking east.

2

Crest of northeast dike looking southeast.

CHA	**PACIFICORP** **NAUGHTON PLANT** **FGD #1 POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

3

Depressions on upstream slope/crest at north end of northeast dike.

4

Over steepening of downstream slope at crest of northeast dike from across road grading.

CHA	**PACIFICORP** **NAUGHTON PLANT** **FGD #1 POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

5

Erosion rivulet at north end of northeast dike adjacent to access road ramp to toe of dike.

6

Typical vegetation cover on north end of FGD #1 Pond downstream slopes.

CHA	**PACIFICORP** **NAUGHTON PLANT** **FGD #1 POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

7

Downstream slope at north end of northeast dike.

8

Sparse vegetation cover on northeast dike downstream slope.

CHA	**PACIFICORP** **NAUGHTON PLANT** **FGD #1 POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

9

Animal burrows along toe of northeast dike (northern end of dike).

10

Slope erosion rivulets and irregular surface on downstream slope at about mid point of northeast dike (area of crack).

11

Depressions along 65-foot long crack observed at about mid length of northeast dike.
Crack located about 12 feet below the top of the dike.

12

Diversion channel along northeast side of FGD #1 Pond toe.

13

Downstream edge of south end of northeast dike.

14

Toe of mid section of northeast dike.

CHA	**PACIFICORP** **NAUGHTON PLANT** **FGD #1 POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

15 

Crest of south end of northeast dike.

16 

Toe of south end of northeast dike.

17

Typical vegetation at south end of northeast dike.

18

Upstream slope of southeast dike looking south.

19

Downstream slope of southeast dike.

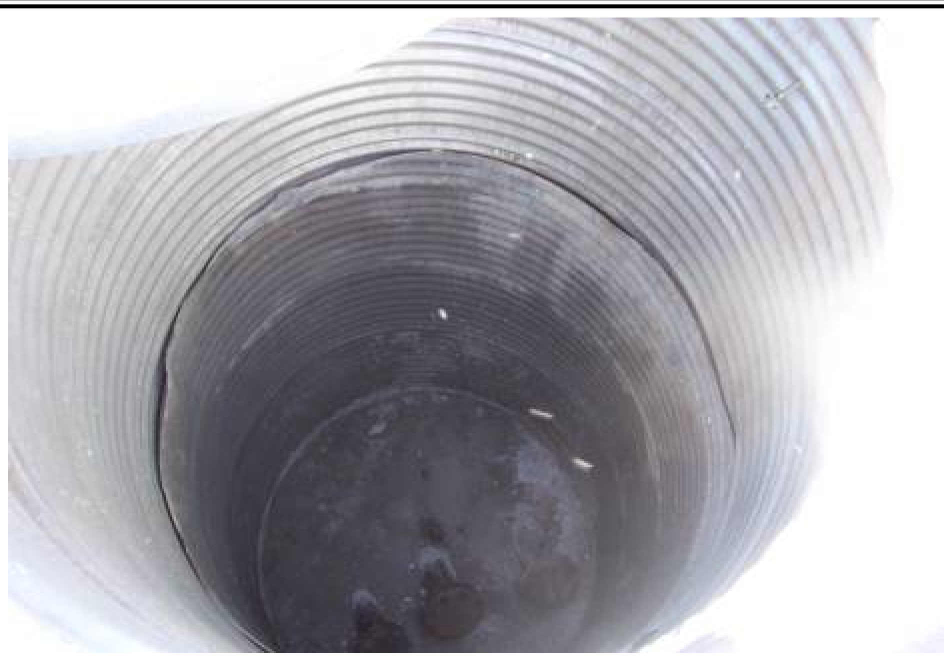
20

Crest of southeast dike.

21

Valve at toe of southeast dike (contains cleanouts to sluice line to FGD #2 Pond.)

22



Valves in vault at toe of southeast dike about 13 feet deep (cleanouts to sluice line to FGD #2 Pond.)

23

Upstream slope south end of southeast dike.

24

Downstream slope at south corner and ramp for access road to crest.

25

Crest of southwest dike looking northwest. Sluice line in foreground.

26

Sluice discharge area along southwest dike.

27

Sluice line at ground surface up downstream slope of southeast dike. Soil piles "anchor" HDPE pipe.

28

Guy wires from adjacent power poles at west dike downstream slope.

29 

Sluice line and sparse vegetation mid section of southeast dike.

30 

Crest north end of southwest dike.

31

Northwest end of FGD #2 Pond incised into original ground.

32

Southwest access road along FGD #2 Pond. Dike begins around closet Power Pole.

33

Upstream slope south dike looking northwest.

34

Downstream slope of south dike. Typical vegetation.

CHA	**PACIFICORP** **NAUGHTON PLANT** **FGD #2 POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

35

Downstream slope looking southeast along south dike.

36

Patch on liner. Routine inspections/maintenance performed to correct holes generated by wildlife.

CHA	PACIFICORP NAUGHTON PLANT FGD #2 POND KEMMERER, WY
CHA Project No.: 20085.2020.1510	September 9, 2009

37

Downstream toe area at south corner. Area of seepage pump back system.

38

Access road at downstream toe at south corner looking east.

39

Downstream slope looking northeast at south corner.

40

Downstream toe and slope at south end of east dike looking south.

41

Animal burrow on east dike.

42

Animal burrow and sparse vegetation on east dike.

43 

Sage shrub on east dike.

44 

Animal burrow on east dike.

CHA	**PACIFICORP** **NAUGHTON PLANT** **FGD #2 POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

45

Downstream slope of east dike looking south.

46

Animal burrows.

47

West end north dike looking west.

48

Erosion rivulet at access road ramp at west end of north dike.

49

Patch along seam in upstream liner along north dike. Soil on top of liner remnant of coffer dam built for repair.

50

Crest of north dike looking northwest. Blends into natural ground.

51

South abutment of Intermediate Dike looking west.

52

Crest of south end of Intermediate Dike looking east.

53

Downstream slope of Intermediate Dike looking east.

54

Clear water pond at toe of south portion of Intermediate Dike.

55 

Breached dike separating clear water pond from recycle pond.

56 

Downstream slope of Intermediate Dike looking northeast.

57

Island in clear water pond maintained for bird nesting habitat.

58

Animal burrows on downstream slope of Intermediate Dike.

59

Decant structure in Primary Pond (looking northwest).

60

Upstream slope of Intermediate Dike looking southwest.

61

Upstream slope of Intermediate Dike looking northeast.

62

Decant structure in Primary pond.

63

Discharge from Primary Pond into clear water pond.

64

Sage brush on downstream slope of Intermediate Dike.

	PACIFICORP **NAUGHTON PLANT** **NORTH ASH POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

65

Cracking and animal burrow or sinkhole on Intermediate Dike. Appears to be related to access road material.

66

Downstream slope at northeast corner of Intermediate Dike looking north.

67

Possible seepage area at north end of Intermediate Dike. Adjacent but downstream of FGD #2 pump back area.

68

Animal burrow on north end of Intermediate Dike.

CHA	PACIFICORP NAUGHTON PLANT NORTH ASH POND KEMMERER, WY
CHA Project No.: 20085.2020.1510	September 9, 2009

69

Looking toward North Abutment (where vehicles are parked).

70

Crest/Downstream slope of the Main Dike looking west. Plant access road crosses the Main Dike.

CHA	**PACIFICORP** **NAUGHTON PLANT** **NORTH ASH POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

71

East groin Main Dike.

72

Upstream slope of Main Dike looking east.

73

Occasional erosion rills on downstream slope at crest of Main Dike.

74

Upstream slope of Main Dike approaching west abutment looking west.

75 

Downstream slope of Main Dike looking west from the outfall structure towards the west abutment.

76 

Main Dike outfall. During low flow, seeps under weir plate.

77

Downstream toe of Main Dike looking east. Cat tails are in rip rap lined discharge channel.

78

Close up of rip rap lined discharge channel from Main Dike outfall.

79

Downstream slope of Main Dike. Sage bushes to be removed.

80

Former weir structure along discharge channel beyond the toe of the main dike.
Discharge channel has bypassed the weir structure on the east side.

81

Discharge channel bypassing weir structure.

82

Occasional animal burrows on downstream slope of Main Dam.

83

South abutment of East Saddle Dike. Note guy wire at right of photo is anchored in the dike.

84

Upstream slope of East Saddle Dike looking north.

85

Downstream slope of East Saddle Dike looking north.

86

Crack at crest/downstream slope of break. Crack appeared intermittently along the length of the East Saddle Dike.

87

Crack at crest/downstream slope of break. Crack appeared intermittently along the length of the East Saddle Dike.

88

East Saddle Dike crest looking toward north abutment.

CHA	**PACIFICORP** **NAUGHTON PLANT** **NORTH ASH POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

89 

Clear water pond is not submerging the north end of the East Saddle Dike at normal pool.

90 

Upstream slope of the East Saddle Dike looking southeast.

CHA	**PACIFICORP** **NAUGHTON PLANT** **NORTH ASH POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 9, 2009

91

Northeast dike crest looking northwest from recycle pond berm intersection (north abutment).

92

Northeast dike crest looking northwest.

93

Northeast dike toe looking southeast.

94

Typical vegetation cover on northeast dike downstream slope (crescent wheat).

95

Standing water at toe of northeast dike "upstream" of discharge channel.

96

Downstream end of outlet control structure on northeast dike.

97

Outflow from control structure.

98

Outflow from control structure.

99

Discharge channel looking northeast.

100

Standing water "upstream" of discharge channel. Plant personnel indicated outflow from pond sometimes higher than during CHA site visit that may back-up into this area. No flow in water observed by CHA.

101

Discharge channel looking northwest.

102

Outlet control structure looking southwest.

103

Close up of outlet control structure.

104

Animal burrow on east dike.

105

Northeast dike downstream slope looking southeast from outlet control structure.

106

Discharge channel diverts away from northeast dike. Possible seepage to southeast (right in photo) of diversion point.

107

Typical vegetation on East dike.

108

Sage bush at toe of east dike. Gravel along lower portion of slope associated with toe drain (looking south).

109

Borrow area beyond toe of East dike slope, looking north.

110

Crest of East dike at downstream slope, looking north.

CHA	PACIFICORP NAUGHTON PLANT SOUTH ASH POND KEMMERER, WY
CHA Project No.: 20085.2020.1510	September 10, 2009

111

Crest of East Dike at upstream slope, looking north.

112

Close up of animal burrow on East Dike, 2 foot rebar sticking out about 6-8 inches.

113

Seepage area at south end of East Dike.

114

East end of South Dike.

115

Typical vegetation on South Dike.

116

Downstream slope of South Dike, looking west.

117 

Close up of animal burrow.

118 

Seepage at South Dike toe, sage bush, looking west.

CHA	**PACIFICORP** **NAUGHTON PLANT** **SOUTH ASH POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 10, 2009

119

South Dike looking east. Rip rap associated with toe drain.

120

West abutment (South Dike). Dike blends into natural ground.

121

Crest of South Dike, looking east.

122

Upstream slope of South Dike, looking east.

PACIFICORP
NAUGHTON PLANT
SOUTH ASH POND
KEMMERER, WY

123

Typical vegetation at upper portion of South Dike downstream face.

124

Occasional erosion rills along crest/downstream slope contact on South Dike.

CHA	**PACIFICORP** **NAUGHTON PLANT** **SOUTH ASH POND** **KEMMERER, WY**
CHA Project No.: 20085.2020.1510	September 10, 2009

125

Animal burrow obscured by vegetation.

126

Crest of Intermediate Dike, looking west. Upstream and downstream faces covered with large rip rap.
Primary pond to the left, clear water pond to the right.

127

Decant structure in primary pond.

128

Typical rip rap on submerged slope extends below the water level.

129 

Intake.

130 

Area of discharge into clear water pond submerged and surrounded by rip rap.

131

Sluice discharge into north side of South Ash Pond.

3.0 DATA EVALUATION

3.1 Design Assumptions

CHA has reviewed the available design assumptions related to the design and analysis of the stability and hydraulic adequacy of the CCW impoundments, which were available at the time of our site visits and provided to us by PacifiCorp. The design assumptions are listed in the following sections.

3.2 Hydrologic and Hydraulic Design

The State of Wyoming dam safety regulations do not provide specific guidelines for the size of hydrologic event for which impoundments are to be designed. Rather these regulations reference the Mine Safety and Health Administration (MSHA), which provides guidelines suggesting that Significant Hazard impoundments, such as the facilities at the Naughton Power Station, meet the criteria shown in Table 1:

Table 1 - Hydrologic and Hydraulic Design Criteria

Hazard Potential		Impoundment Size <1,000 acre-feet and < 40 feet deep	Impoundment Size ≥1,000 acre-feet and ≥ 40 feet deep
Significant	Short Term	100-year	½ Probable Maximum Flood (PMF)
	Long Term	½ PMF	PMF

The Naughton Facilities are long term type facilities based on the definitions provided by MSHA. Based on the sizes of the Naughton facilities and the hazard classification based on the EPA classification criteria, the FGD #2 Pond should be designed for the ½ PMF and the FGD #1 Pond, North Ash Pond, and South Ash Pond should be designed for the full PMF.

Design reports reviewed by CHA suggest that at the time that the current configuration design of the north and south ash ponds were designed, the State of Wyoming required a minimum design freeboard of 5 feet.

The Naughton Power Station is in an arid region of Wyoming that receives an average annual precipitation of about 10 inches. The 24-hour, 100-year storm is 2.6 inches. The probable maximum precipitation (PMP) from which to develop the PMF is determined from the National Weather Service Hydrometerological Report (HMR) 49. However, the Naughton site is in the outer reaches of the region for which HMR 49 applies, and the report suggests the gage data used to develop the method is not as reliable for this area.

3.2.1 FGD #1 Pond

The FGD #1 Pond was designed as an evaporation pond. A freeboard analysis was performed to evaluate the freeboard required to contain a two back-to-back 100-year storms with 100 mile per hour waves. The 100-year, 24-hour rainfall data was reported to be 2.6 inches. Using the basin storage-elevation rating curve, Maxim determined that two back-to-back 100-year, 24-hour storms would result in an increase in the water surface of about ½ foot. The wave run-up analysis results indicate 100 mph winds will result in a run-up of 2.2 feet. Therefore, to meet these design criteria, a total freeboard of 2.7 feet is needed. PacifiCorp indicated that they maintain at least 3 feet of freeboard in FGD #1 Pond.

A diversion ditch bypasses the FGD #1 Pond to the north to convey upstream drainage area flow around the FGD #1 Pond. This diversion ditch was evaluated for the 100-year and the probable maximum thunderstorm peak discharge from the upstream watershed. The probable maximum thunderstorm resulted in a higher peak discharge and was used to size the diversion ditch.

3.2.2 FGD #2 Pond

The FGD #2 Pond was designed as an evaporation pond. A freeboard analysis was performed to evaluate the freeboard required to contain a two back-to-back 100-year storms with 100 mile per hour waves. The 100-year, 24-hour rainfall data was reported to be 2.6 inches. Using the basin storage-elevation rating curve, Maxim determined that two back-to-back 100-year, 24-hour storms would result in an increase in the water surface of about ½ foot. The wave run-up analysis results indicate 100 mph winds will result in a run-up of 2.3 feet. Therefore, to meet these design criteria, a total freeboard of 2.8 feet is needed. PacifiCorp indicated that they maintain at least 5 feet of freeboard in FGD #2 Pond.

A diversion ditch bypasses the FGD #2 Pond to the north to convey upstream drainage area flow around the FGD #1 Pond. This diversion ditch was evaluated for the 100-year and the probable maximum thunderstorm peak discharge from the upstream watershed. The probable maximum thunderstorm resulted in a higher peak discharge and was used to size the diversion ditch.

3.2.3 North Ash Pond

The expanded North Ash Pond was evaluated for two back-to-back 100-year storm events. The designed sizes of the ash basin and the clearwater basin allow for enough storage under this storm scenario that with a maximum outflow from the discharge structure of the clearwater pond of 7 cfs, that a rise in water level within the basins of one foot or less is anticipated. The peak stage of the ash and clearwater basins are anticipated to be 6901.0 and 6885.8, respectively.

3.2.4 South Ash Pond

The South Ash Pond was evaluated for two back-to-back 100-year storm events. The designed sizes of the ash basin and the clearwater basin allow for enough storage under this storm scenario that with a maximum outflow from the discharge structure of the clearwater pond of 6 cfs, a rise in water level within the basins of less than one foot is anticipated. The peak stage of the ash and clearwater basins are anticipated to be 6885.9 and 6882.7, respectively.

3.3 Structural Adequacy & Stability

Wyoming DEQ references MSHA dam design guidelines for embankment dams. These guidelines suggest the following guidance values for minimum factors of safety as shown in Table 2.

Table 2 - Minimum Safety Factors Recommended by MSHA

Load Case	Required Minimum Factor of Safety
Steady State	1.5
Rapid Drawdown	1.3
Seismic Conditions from Present Pool Elevation	1.2

CHA reviewed design reports for the Naughton Power Station impoundments provided by PacifiCorp. Sections 3.3.1 through 3.3.4 discuss our review of the stability analyses and performance of the FGD #1 Pond, FGD #2 Pond, North Ash Pond, and South Ash Pond, respectively.

3.3.1 FGD #1 Pond

The most recent expansion which raised FGD #1 Pond was in 2005. As part of the design work for this raising, Maxim Technologies, Inc. (Maxim) performed stability analyses using soil properties based on laboratory testing they performed as well as testing performed by original designers of the FGD #1 Pond. The stability was evaluated at the section with the maximum height, which is at the south end of the pond. Table 3 summarizes the strength parameters for the various soil layers analyzed for stability.

Table 3 - Soil Strength Parameters Used by Maxim Technologies for FGD #1 Pond Stability Analyses

Soil Stratum	Unit Weight (pcf)	Friction Angle (φ)	Cohesion (psf)
Fill	122	26°	600
Lean Clay	119.5	25°	200
Claystone	130.2	0°	4000
Solids (disposed material)	80	0°	0

Downstream slope steady state, and earthquake loading conditions were analyzed and Table 4 provides a summary of the results and Figure 10 show details of the analysis.

Table 4 - Summary of Design Stability Analysis for the FGD #1 Pond

Loading Condition	Required Minimum Factor of Safety	Calculated Factor of Safety
Steady State	1.5	2.0
Earthquake (0.10g)	1.0	1.6

Rapid drawdown is not an applicable condition at the FGD #1 Pond because the pond is fully lined with an impermeable liner because the pond is not inducing pore pressures within the embankment.

3.3.2 FGD #2 Pond

The FGD #2 Pond was constructed in 1996. Maxim Technologies, Inc. (Maxim) used the same design material properties as for FGD #1 Pond which represented the weakest soil conditions and the embankment was analyzed at the maximum height. Table 5 summarizes the strength parameters for the various soil layers analyzed for stability.

Table 5 - Soil Strength Parameters Used by Maxim Technologies for FGD #2 Pond Stability Analyses

Soil Stratum	Unit Weight (pcf)	Friction Angle (φ)	Cohesion (psf)
Fill	122	26°	600
Fill for Rapid Drawdown	122	0°	1000
Lean Clay	119.5	25°	200
Claystone	130.2	0°	4000
Solids (disposed material)	80	0°	0

Downstream slope steady state, and earthquake loading conditions were analyzed and Table 6 provides a summary of the results and Figure 5B show details of the analysis.

Table 6 - Summary of Design Stability Analysis for the FGD #2 Pond

Loading Condition	Required Minimum Factor of Safety	Calculated Factor of Safety
Steady State	1.5	1.5
Rapid Drawdown	1.3	1.1
Earthquake (0.10g)	1.2	1.6

Despite being fully lined with an impermeable liner, Maxim evaluated, and the results presented in Table 6 above, FGD #1 Pond with a fully developed phreatic surface through the embankment, and a rapid drawdown was performed. Although the factor of safety for the rapid drawdown condition is less than recommended, this is not a likely condition of FGD #2 Pond because it is a fully lined pond.

3.3.3 North Ash Pond

CHA reviewed the engineering design report for the current North Ash Pond complex prepared by Black & Veatch. In this report, Black & Veatch indicated that shear strengths were developed by using standard penetration test (SPT) data and correlations in NAVFAC DM 7.01 between SPT and shear strength. They then used 80 percent of the correlation value to add conservatism to the design. Laboratory compacted test specimens were tested to determine the expected strength of the embankment fill to be used in the construction of these impoundments. Design values were selected at the 20th percentile of these tested re-compacted specimens (i.e., 80 percent of the tests resulted in higher strengths). Tests on soils obtained from the existing North Ash Pond embankment were taken and the design strength for the existing embankment used in the design of the new North Ash Pond embankments was taken from the 50th percentile of tests data obtained.

The resulting soil strength parameters used in the stability analyses are summarized in Table 7 below:

Table 7 - Soil Strength Parameters – North Ash Pond Embankments

Soil Stratum	Unit Weight (pcf)	Drained Friction Angle (φ)	Drained Cohesion (psf)
New Embankment Fill	124.7	24°	350
Existing Embankment Fill	110	23	250
Insitu Soil 0 – 5 feet 5 – 10 feet >10 feet	 100 100 100	 23° 23° 24°	 300 400 450
Very Soft to Stiff Soil Near Unit 3 Clear Water Pond	100	23°	200
Bedrock	125	0°	4000

Factors of safety for slope stability were determined from models of critical embankment sections (generally, maximum height sections). These cross sections were determined from conditions observed in soil borings for the design of these impoundments. Black & Veatch then conservatively assumed the top of bedrock to be 5 feet deeper than where it was actually encountered in the soil borings.

Table 8 - Summary of Design Stability Analysis for the North Ash Pond Intermediate Dike

Loading Condition	Required Minimum Factor of Safety	Upstream Slope Calculated Factor of Safety	Downstream Slope Calculated Factor of Safety
Steady State	1.5	2.7	1.8
Rapid Drawdown	1.3	1.8	2.0
Earthquake (0.10g)[1]	1.2	1.8	1.9

Table 9 - Summary of Design Stability Analysis for the North Ash Pond Main Dike

Loading Condition	Required Minimum Factor of Safety	Upstream Slope Calculated Factor of Safety	Downstream Slope Calculated Factor of Safety
Steady State	1.5	2.7	1.9
Rapid Drawdown	1.3	1.7	1.6
Earthquake (0.10g)[1]	1.2	1.6	1.1[2]

[1] Corps of Engineers Zone 2 Seismic Area
[2] Black & Veatch used minimum Factor of Safety criteria of 1.1. Corps of Engineers guidelines suggests "greater than 1.0".

The design report indicated the following design and construction considerations to ensure stable foundation and embankment placement:

- The top 5 feet of soil directly below new embankments was to be excavated and replaced with compacted material.
- Very soft to soft (undrained shear strength less than 1,000 psf) soil beneath the new embankments was to be excavated and replaced or improved. Subsurface investigations had indicated that soils of this nature were anticipated in the location of the North Ash Pond Main Embankment.

- Ash fill beneath the new embankments and within 10 feet of the toe of an embankment was to be excavated and replaced. The North Ash Pond intermediate embankment was to be constructed well downstream of the previous Ash Pond embankment because of concerns of low strength and general inconsistencies in obtained strength data.

3.3.4 South Ash Pond

CHA reviewed the engineering design report for the current North Ash Pond complex prepared by Black & Veatch. In this report, Black & Veatch indicated that shear strengths were developed by using standard penetration test (SPT) data and correlations in NAVFAC DM 7.01 between SPT and shear strength. They then used 80 percent of the correlation value to add conservatism to the design. Laboratory compacted test specimens were tested to determine the expected strength of the embankment fill to be used in the construction of these impoundments. Design values were selected at the 20th percentile of these tested re-compacted specimens (i.e., 80 percent of the tests resulted in higher strengths).

The resulting soil strength parameters used in the stability analyses are summarized in Table 10 below:

Table 10 - Soil Strength Parameters – South Ash Pond Embankments

Soil Stratum	Unit Weight (pcf)	Drained Friction Angle (φ)	Drained Cohesion (psf)
New Embankment Fill	124.7	24°	350
Insitu Soil 0 – 5 feet 5 – 10 feet >10 feet	 100 100 100	 23° 23° 24°	 300 400 450
Bedrock	125	0°	4000

Factors of safety for slope stability were determined from models of critical embankment sections (generally, maximum height sections). These cross sections were determined from conditions observed in soil borings for the design of these impoundments. Black & Veatch then conservatively assumed the top of bedrock to be 5 feet deeper than where it was actually encountered in the soil borings.

Table 11 - Summary of Design Stability Analysis for the South Ash Pond Intermediate Dike

Loading Condition	Required Minimum Factor of Safety	Upstream Slope Calculated Factor of Safety	Downstream Slope Calculated Factor of Safety
Steady State	1.5	2.4	>2.4
Rapid Drawdown	1.3	2.3	>2.3
Earthquake (0.10g)[1]	1.2	2.6	>2.6

[1] Corps of Engineers Zone 2 Seismic Area

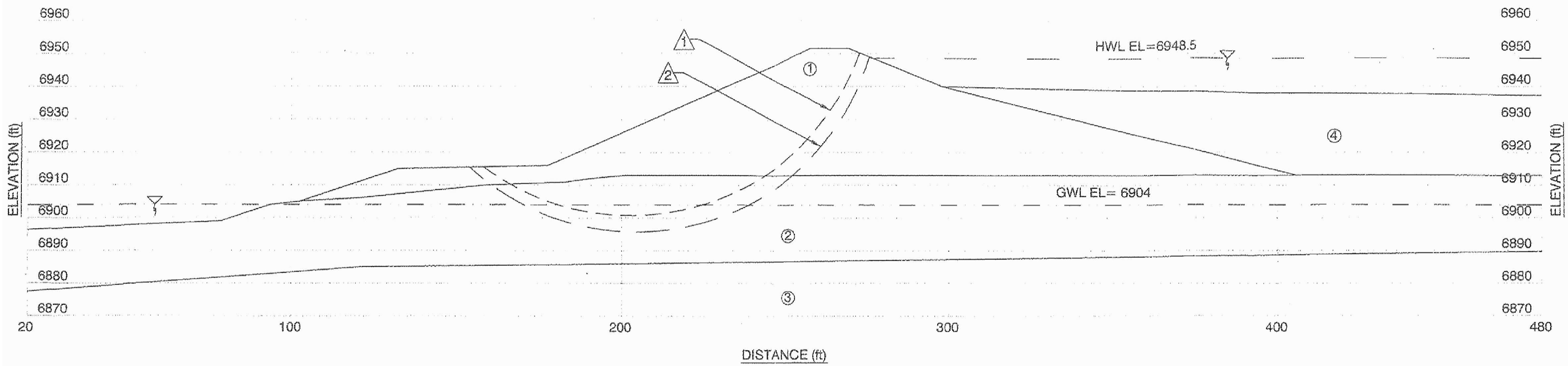
Table 12 - Summary of Design Stability Analysis for the South Ash Pond Main Dike

Loading Condition	Required Minimum Factor of Safety	Upstream Slope Calculated Factor of Safety	Downstream Slope Calculated Factor of Safety
Steady State	1.5	2.3	1.8
Rapid Drawdown	1.3	1.9	1.7
Earthquake (0.10g)[1]	1.2	2.2	1.3

[1] Corps of Engineers Zone 2 Seismic Area

The design report indicated the following design and construction considerations to ensure stable foundation and embankment placement:

- The top 5 feet of soil directly below new embankments was to be excavated and replaced with compacted material.
- Ash fill beneath the new embankments and within 10 feet of the toe of an embankment was to be excavated and replaced. Information available to Black & Veatch suggested that there was ash fill present under the northern portion of the South Ash Pond complex.



SOIL LAYER	WET UNIT WEIGHT (pcf)	COHESION (pcf)	FRICTION ANGLE (°)
① FILL	122.0	600	26
② LEAN CLAY	119.5	200	25
③ CLAYSTONE	130.2	4000	0
④ SOLIDS	80.0	0	0

CASE	1	2
CONDITIONS	STATIC	PSEUDO-STATIC
MINIMUM FACTOR OF SAFETY	2.02	1.56
REQUIRED FACTOR OF SAFETY	1.5	1.0
SEISMIC COEFFICIENT	0.00 g	0.10 g

IMAGE REFERENCE: STABILITY ANALYSIS, SECTION A, STEADY STATE, NAUGHTON POWER PLANT, FGD POND 1 MODIFICATIONS, SHEET D-3, MAXIM TECHNOLOGIES, INC.

CHA
III Winners Circle, PO Box 5269 - Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

FGD #1 POND
TYPICAL CROSS SECTION AND STABILITY ANALYSES
NAUGHTON POWER STATION
KEMMERER, WYOMING

PROJECT NO. 20085.2020

DATE: 10/2009

FIGURE 10

4.0 CONCLUSIONS/RECOMMENDATIONS

4.1 Acknowledgement of Management Unit Condition

I acknowledge that the management units referenced herein was personally inspected by me and was found to be in the following condition: **Satisfactory.**

A management unit found to be in satisfactory condition is defined as one in which no existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions in accordance with the applicable criteria. Minor maintenance items may be required.

CHA's assessment of the FGD #1, FGD #2, North Ash and South Ash Ponds indicate that they are in satisfactory condition. As described in the following sections, maintenance and monitoring will further enhance the condition of these embankments.

4.2 Filling of Depressions, Erosion Rills, and Animal Burrows

We recommend depressions on the FGD #1 Pond dike where the sluice lines formerly crossed the crest be backfilled. Ongoing maintenance of backfilling erosion rills and animal burrows should be backfilled. Measures should be taken to discourage burrowing animals from inhabiting the embankment areas.

4.3 Vegetation Control

CHA understands that PacifiCorp is reluctant to mow the vegetation on the embankments because of the difficulty in establishing and maintaining vegetative growth. CHA understands that crested wheatgrass is appropriate for animal forage and haying, which would suggest it can be cut at least once a year. We recommend PacifiCorp discuss vegetation cutting options with the Wyoming office of the Natural Resources Conservation Service (NRCS) or co-op extension. Cutting of the grass will help deter burrowing animals and allow for better inspection of the embankments immediately after mowing.

Sage bushes were found growing on the embankments. These should be removed when observed, and not allowed to grow on the embankments because the deep root system could provide shortened paths for seepage, which can lead to instability in the embankments.

4.4 Cracking

CHA observed cracks in three locations; the northeast dike on FGD #1 Pond, the East Saddle Dike of the North Ash Pond, and on the Intermediate Dike of the North Ash Pond. These cracks appeared shallow, (two feet deep or less) and there were not signs of movement of the slopes around them. However, these cracks should be monitored closely for signs of increasing length, depth, or movement on the slopes.

4.5 Seepage Monitoring

CHA observed the areas of seepage that PacifiCorp described in the kick-off meeting. Two additional areas were observed that may be seepage or may be related to ponded water from high flows in the South Ash Pond discharge channel. CHA recommends that monitoring structures such as V-notch weirs be installed in the areas of known seepage so quantitative measurements can be made and compared over time.

CHA recommends that the areas of standing water and possible seepage to the northwest of the south ash pond outlet structure and to the southeast of the point where the discharge channel veers away from the dike, respectively, be evaluated to understand the source of constant moisture in these areas, and corrective actions be taken to reduce standing water in these areas.

4.6 Phreatic Surface Monitoring

There are no piezometers installed in the embankments. The stability analyses for the North and South Ash Pond embankments were performed with some assumed phreatic surface elevations. Monitoring of the actual phreatic surface is an approach to confirm that the embankments are performing as designed and CHA recommends installing piezometers for this evaluation. Because the FGD Ponds are lined, there should not be a phreatic surface in the embankments. However, piezometric monitoring can confirm that this is the case and that therefore, the embankments and liner are performing as designed.

4.7 Hydrologic Design

Based on the EPA hazard classification, the FGD #2 Pond should be designed for a ½ PMF design storm and the FGD #1, North and South Ash Ponds should be designed for a full PMF. Because the Naughton Plant is in a region that is on the outer limits of the applicable region for the method for developing the PMP, and because the impoundments were designed for two back-to-back 100-years storms, which in this arid region may be similar in magnitude to a PMP, CHA recommends that PacifiCorp evaluate the PMP for this site, and compare the impacts of this design storm on the impoundments.

5.0 CLOSING

The information presented in this report is based on visual field observations, review of reports by others and this limited knowledge of the history of the Naughton Power Station surface impoundments. The recommendations presented are based, in part, on project information available at the time of this report. No other warranty, expressed or implied is made. Should additional information or changes in field conditions occur, the conclusions and recommendations provided in this report should be re-evaluated by an experienced engineer.

APPENDIX A

Completed EPA Coal Combustion Dam Inspection Checklist Forms

&

Completed EPA Coal Combustion Waste (CCW) Impoundment Inspection Forms

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Naughton Power Station	Date: 09-09-09
Unit Name: FDG #1 Pond	Operator's Name: PacifiCorp
Unit I.D.: FDG #1	Hazard Potential Classification: High Significant Low
Inspector's Name: Katherine Adnams & John Sobiech	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	See Note		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	6957		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	Not Applicable		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	Not Applicable		Is water entering inlet, but not exiting outlet?	NA	
5. Lowest dam crest elevation (operator records)?	6966		Is water exiting outlet, but not entering inlet?	NA	
6. If instrumentation is present, are readings recorded (operator records)?	NA		Is water exiting outlet flowing clear?	NA	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	NA		From underdrain?	NA	
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?	NA	
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	NA		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?	NA		Around the outside of the decant pipe?	NA	
15. Are spillway or ditch linings deteriorated?	NA		22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?	NA		23. Water against downstream toe?		X
17. Cracks or scarps on slopes?	X		24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1.	Daily Observations are made by plant personnel. State of Wyoming Dam Safety program makes inspections about every 5 years. February 2009 independent consultant inspection made. PacifiCorp reported plan to implement annual outside consultant inspections.
2.	No active instrumentation present.
9.	Occasional sage brush 1 to 3 inch diameter.
3., 4., 12., 14.-16. and 20.	FGD #1 is designed as an evaporation pond (i.e., no outlet)
17.	65-foot long crack on northeast side of pond downstream slope about 12 feet from the crest. Probe penetrates up to 2 feet deep.

NA = Not Applicable

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # WY0020311 INSPECTOR Adnams/Sobiech
Date September 9, 2009

Impoundment Name FGD #1 Pond
Impoundment Company PacifiCorp Energy
EPA Region 8
State Agency (Field Office) Addresss Wyoming Department of Environmental Quality
510 Meadowview Drive, Lander, WY 82520
Name of Impoundment FGD #1 Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ________ Update X

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Primarily flue gas desulfurization residuals disposal

Nearest Downstream Town : Name Granger, WY
Distance from the impoundment Approx. 55 miles
Impoundment
Location: Longitude 109 Degrees 58 Minutes 08 Seconds
Latitude 41 Degrees 35 Minutes 29 Seconds
State WY County Sweetwater

Does a state agency regulate this impoundment? YES X NO ______

If So Which State Agency? WY Department of Environmental Quality, Division of Water

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

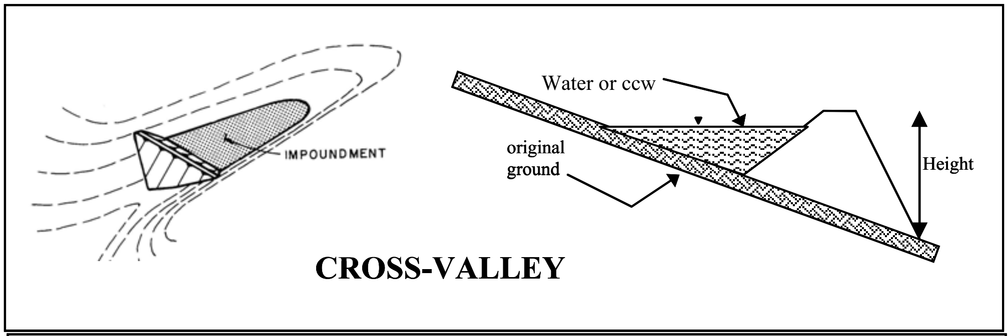
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

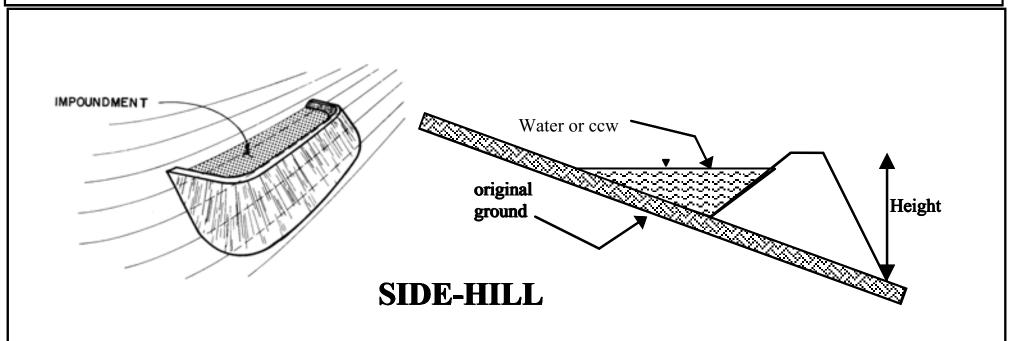
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

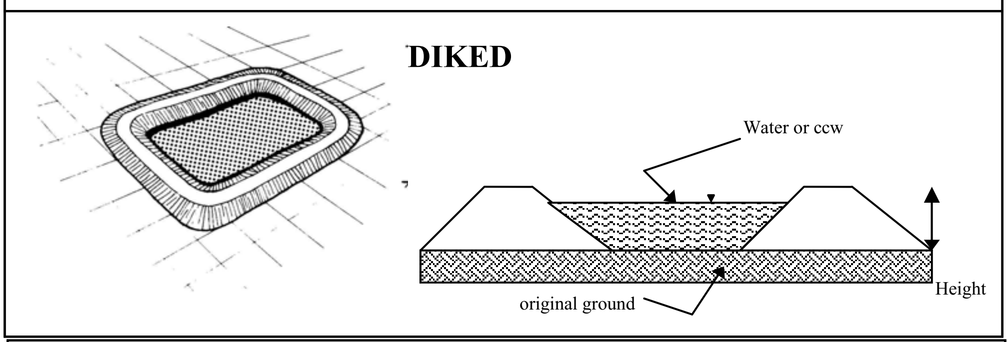
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

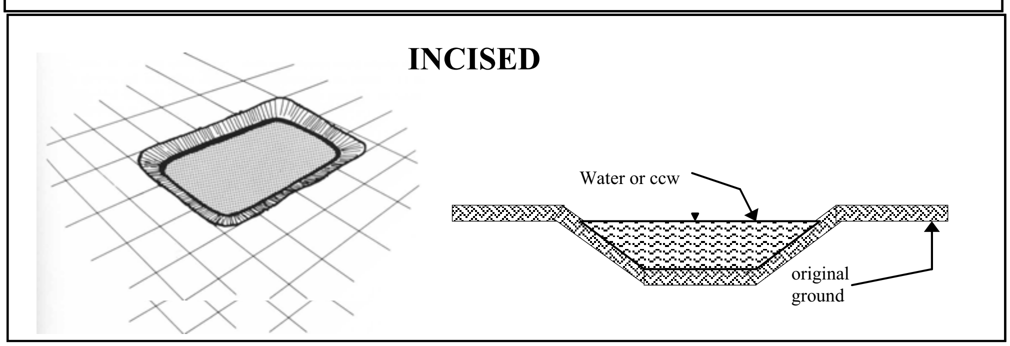
Breach of the FGD #1 dike could result in a release of coal combustion by-product to adjacent properties.

<u>CONFIGURATION</u>:









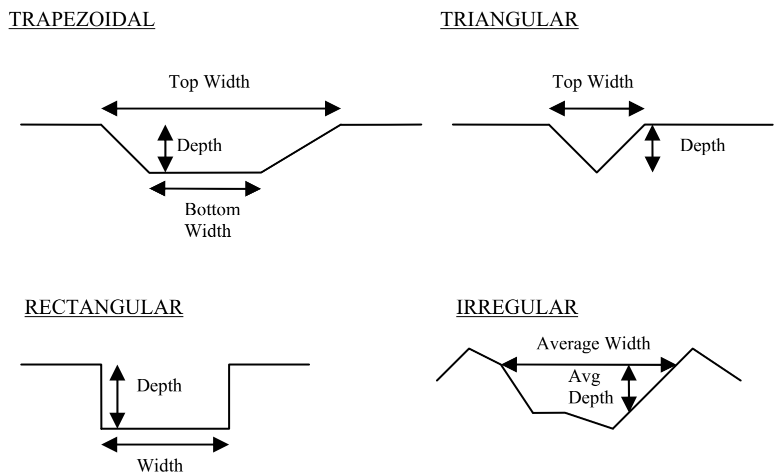
______ Cross-Valley
______ Side-Hill
__X__ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

Embankment Height __36.5__ feet Embankment Material __Compacted clay__
Pool Area __40__ acres Liner __30mil PVC__
Current Freeboard __9__ feet Liner Permeability __-__

TYPE OF OUTLET (Mark all that apply)

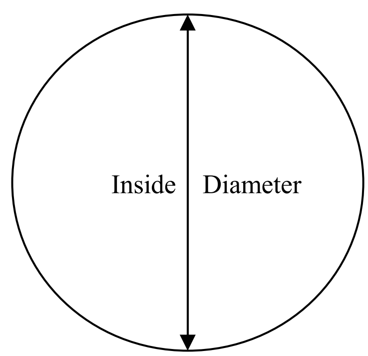
______ **Open Channel Spillway**
______ Trapezoidal
______ Triangular
______ Rectangular
______ Irregular

______ depth
______ bottom (or average) width
______ top width



______ **Outlet**

______ inside diameter



Material
______ corrugated metal
______ welded steel
______ concrete
______ plastic (hdpe, pvc, etc.)
______ other (specify) ______________________

Is water flowing through the outlet? YES __X__ NO _______

__X__ **No Outlet**

______ **Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By Bechtel (1981), Maxim Technologies, Inc. (Raising 2002)

Has there ever been a failure at this site? YES __________ NO ___X___

If So When? ____________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES _______ NO ___X___

If So When? ___________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower
Phreatic water table levels based on past seepages or breaches
at this site? YES ________ NO __X__

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ________________________________

Note - Impoundment is lined with 30mil PVC liner.

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Naughton Power Station	Date: 09-09-09
Unit Name: FDG #2 Pond	Operator's Name: PacifiCorp
Unit I.D.: FDG #2	Hazard Potential Classification: High Significant Low
Inspector's Name: Katherine Adnams & John Sobiech	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	See Note		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	6905		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	Not Applicable		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	Not Applicable		Is water entering inlet, but not exiting outlet?	NA	
5. Lowest dam crest elevation (operator records)?	6923		Is water exiting outlet, but not entering inlet?	NA	
6. If instrumentation is present, are readings recorded (operator records)?	NA		Is water exiting outlet flowing clear?	NA	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	NA		From underdrain?	NA	
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?	NA	
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	NA		From downstream foundation area?	X	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?	NA		Around the outside of the decant pipe?	NA	
15. Are spillway or ditch linings deteriorated?	NA		22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?	NA		23. Water against downstream toe?		X
17. Cracks or scarps on slopes?	X		24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1.	Daily Observations are made by plant personnel. State of Wyoming Dam Safety program makes inspections about every 5 years. February 2009 independent consultant inspection made. PacifiCorp reported plan to implement annual outside consultant inspections.
2.	No active instrumentation present.
9.	Occasional sage brush 1 to 3 inch diameter.
3., 4., 12., 14.-16. and 20.	FGD #2 is designed as an evaporation pond (i.e., no outlet)
21.	Seepage was identified based on water chemistry in 2006 to be originating from FGD #2. A cutoff trench and pump back system was installed in November 2006 to reduce the risk of seeping water migrating downstream.

NA = Not Applicable

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # WY0020311 INSPECTOR Adnams/Sobiech

Date September 9, 2009

Impoundment Name FGD #2 Pond

Impoundment Company PacifiCorp Energy

EPA Region 8

State Agency (Field Office) Addresss Wyoming Department of Environmental Quality
510 Meadowview Drive, Lander, WY 82520

Name of Impoundment FGD #2 Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ________ Update X

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Primarily flue gas desulfurization residuals disposal

Nearest Downstream Town : Name Granger, WY

Distance from the impoundment Approx. 55 miles

Impoundment

Location: Longitude 109 Degrees 58 Minutes 08 Seconds

Latitude 41 Degrees 35 Minutes 29 Seconds

State WY County Sweetwater

Does a state agency regulate this impoundment? YES X NO ______

If So Which State Agency? WY Department of Environmental Quality, Division of Water

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

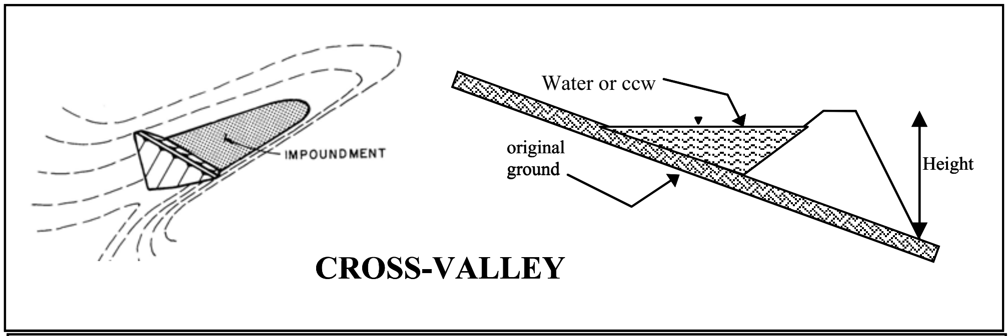
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

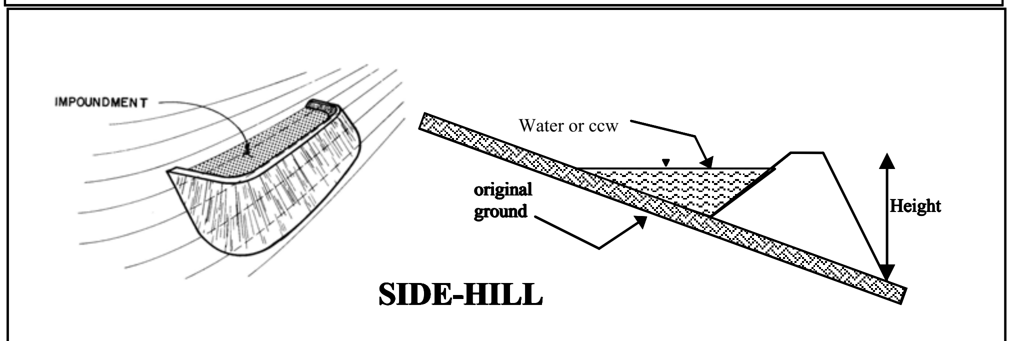
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

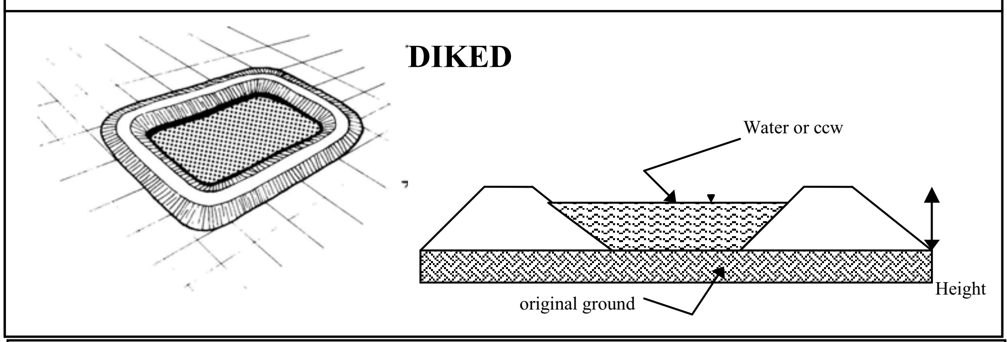
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

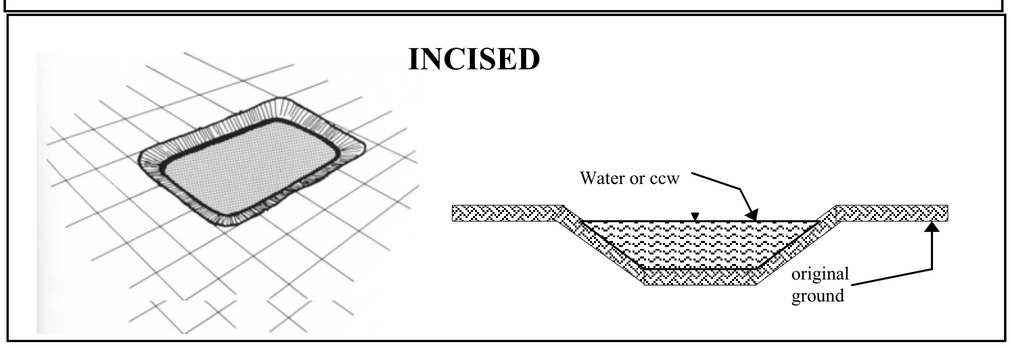
Breach of the FGD #2 dike could result in a release of coal combustion by-product to adjacent properties.

CONFIGURATION:









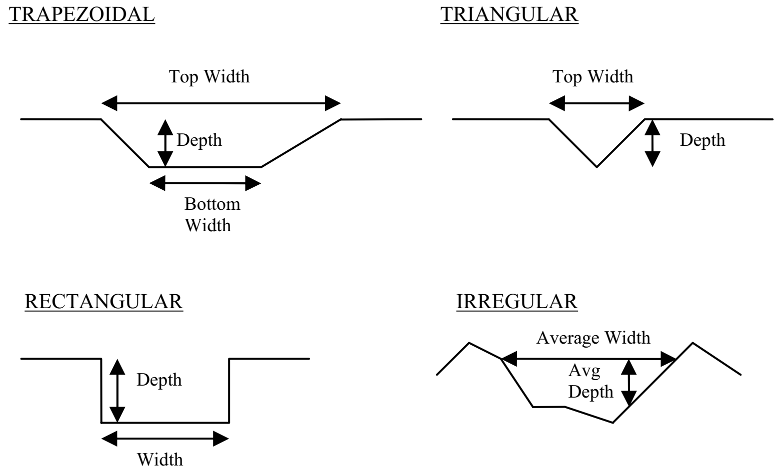
______ Cross-Valley
______ Side-Hill
__X__ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

Embankment Height ___33___ feet   Embankment Material ___Compacted clay___
Pool Area ___40___ acres   Liner ___40mil HDPE___
Current Freeboard ___10___ feet   Liner Permeability ___-___

TYPE OF OUTLET (Mark all that apply)

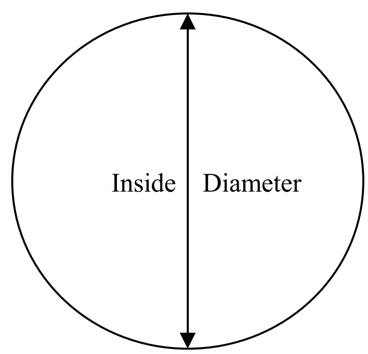
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width



_____ **Outlet**

_____ inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES __X__ NO _______

__X__ **No Outlet**

_____ **Other Type of Outlet** (specify) ______________________________

The Impoundment was Designed By Maxim Technologies, Inc.

Has there ever been a failure at this site? YES __________ NO X

If So When? 2006

If So Please Describe :

Has there ever been significant seepages at this site? YES __X__ NO ______

If So When? 2006

IF So Please Describe:

Seepage was identified based on water chemistry in 2006 to be originating from FGD#2. A off trench and pump back system was installed in November 2006 to reduce the risk of seeping water from migrating downstream.

Has there ever been any measures undertaken to monitor/lower
Phreatic water table levels based on past seepages or breaches
at this site? YES ________NO __X__

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ______________________________

Impoundment is lined with 30mil PVC liner.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Naughton Power Station	Date: 09-09-09
Unit Name: North Ash Pond	Operator's Name: PacifiCorp
Unit I.D.: North Ash Pond (Unit 3)	Hazard Potential Classification: High Significant Low
Inspector's Name: Katherine Adnams & John Sobiech	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	See Note		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	6905/6891		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	Unknown		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	Not Applicable		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	6915/6898		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	NA		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	NA		From underdrain?	NA	
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?	X		At natural hillside in the embankment area?	X	
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	X		From downstream foundation area?	X	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?		X
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1.	Daily Observations are made by plant personnel. State of Wyoming Dam Safety program makes inspections about every 5 years.
	February 2009 independent consultant inspection made. PacifiCorp reported plan to implement annual outside consultant inspections.
2., 5.	Lower elevations represent clear water pool. Higher elevations represent main sedimentation pond and intermediate dike.
6.	No active instrumentation present.
9.	Occasional sage brush 1 to 3 inch diameter.
10.	Crack noted along downstream crest of east saddle dike.
21.	Seepage areas evidenced by change in vegetation growth. Flow too small to estimate visually, no sediment transport observed.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # WY0020311 INSPECTOR Adnams/Sobiech

Date September 9, 2009

Impoundment Name North Ash Pond

Impoundment Company PacifiCorp Energy

EPA Region 8

State Agency (Field Office) Addresss Wyoming Department of Environmental Quality
510 Meadowview Drive, Lander, WY 82520

Name of Impoundment North Ash Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ________ Update X

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Primarily flyash, bottom ash, boiler slag, yard runoff and other wastewater

Nearest Downstream Town : Name Granger, WY

Distance from the impoundment Approx. 55 miles

Impoundment
Location: Longitude 109 Degrees 58 Minutes 08 Seconds
Latitude 41 Degrees 35 Minutes 29 Seconds
State WY County Sweetwater

Does a state agency regulate this impoundment? YES X NO ______

If So Which State Agency? WY Department of Environmental Quality, Division of Water

<u>HAZARD POTENTIAL</u> (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

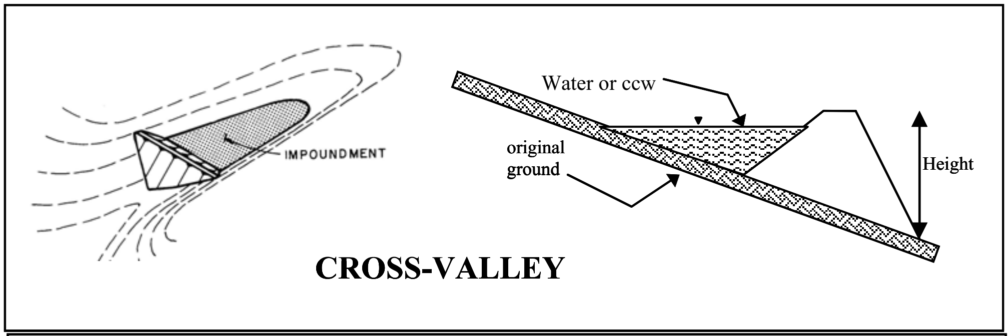
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

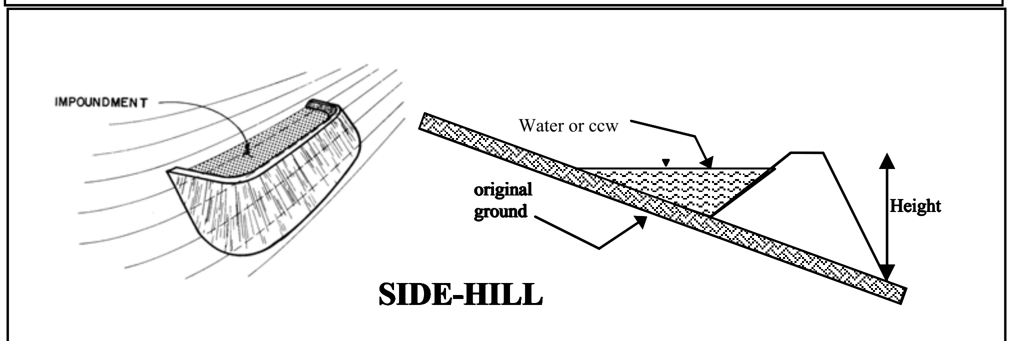
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

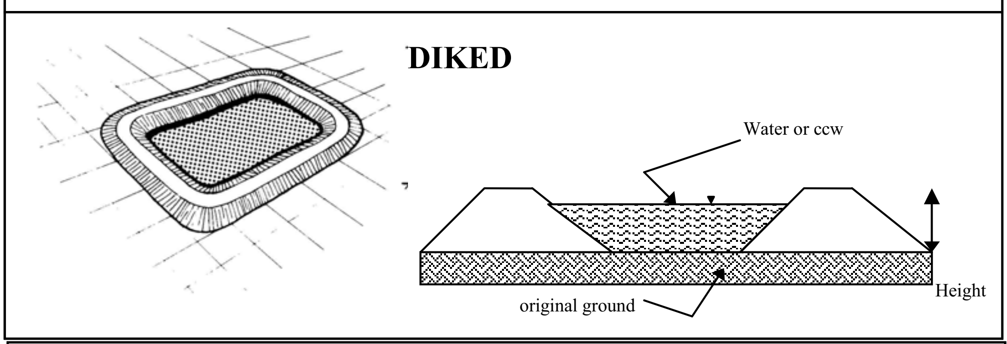
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

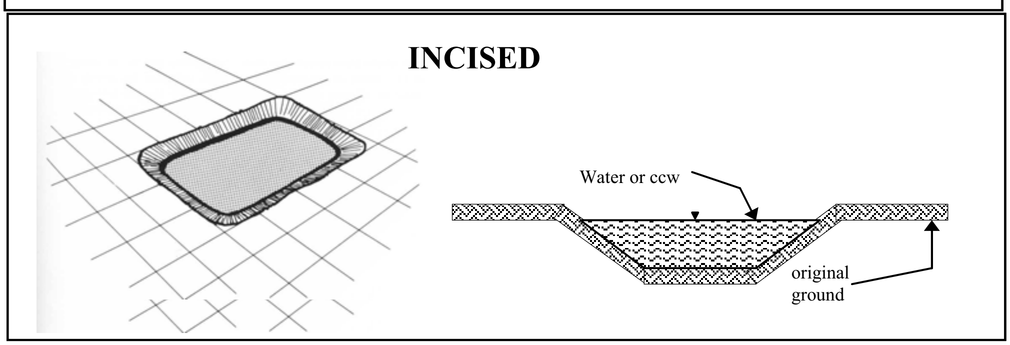
Breach of the North Ash Pond dike system could result in a release of coal combustion by-product to adjacent properties.

CONFIGURATION:









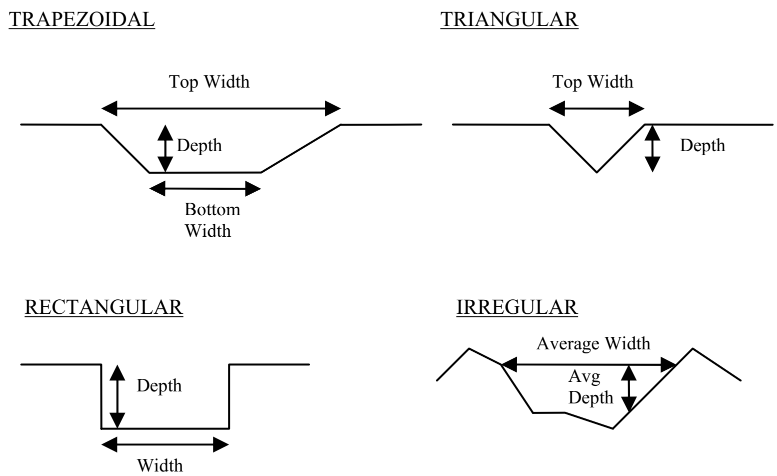
__X__ Cross-Valley
_____ Side-Hill
_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height __61__ feet   Embankment Material __Compacted clay__
Pool Area __151.5__ acres   Liner __None__
Current Freeboard __7 to 10__ feet   Liner Permeability __None__

TYPE OF OUTLET (Mark all that apply)

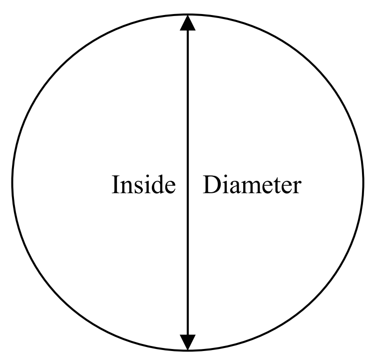
______ **Open Channel Spillway**
______ Trapezoidal
______ Triangular
______ Rectangular
______ Irregular

______ depth
______ bottom (or average) width
______ top width



__X__ **Outlet**

______ inside diameter



Material
______ corrugated metal
______ welded steel
______ concrete
______ plastic (hdpe, pvc, etc.)
______ other (specify) ______________________

__X__ Unknown (inaccessible)

Is water flowing through the outlet? YES __X__ NO _______

______ **No Outlet**

______ **Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By Black & Veatch
____

Has there ever been a failure at this site? YES __________ NO ___X___

If So When? ___________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES _______ NO ___X___

If So When? ___________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________ NO ___X___

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____________________

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Naughton Power Station	Date: 09-10-09
Unit Name: South Ash Pond	Operator's Name: PacifiCorp
Unit I.D.: South Ash Pond (Units 1&2)	Hazard Potential Classification: High **Significant** Low
Inspector's Name: Katherine Adnams & John Sobiech	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	See Note		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	6922		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	Unknown		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	Not Applicable		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	6927		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?		X	Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	NA		From underdrain?	X	
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		X	From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?		X
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1.	Daily Observations are made by plant personnel. State of Wyoming Dam Safety program makes inspections about every 5 years. February 2009 independent consultant inspection made. PacifiCorp reported plan to implement annual outside consultant inspections.
6.	No active instrumentation present.
9.	Occasional sage brush 1-3 inch diameter.
12.	Decant structure from cell well is a drop inlet pipe, no trashrack visible, minor debris at top of pipe.
21.	Seepage along southeast corner toe and mid-point of south toe. No evidence of sediment transport. Ground wet, flow not observed.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW) Impoundment Inspection

Impoundment NPDES Permit # WY0020311 INSPECTOR Adnams/Sobiech

Date September 10, 2009

Impoundment Name South Ash Pond

Impoundment Company PacifiCorp Energy

EPA Region 8

State Agency (Field Office) Addresss Wyoming Department of Environmental Quality
510 Meadowview Drive, Lander, WY 82520

Name of Impoundment South Ash Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ________ Update X

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Primarily flyash, bottom ash, boiler slag, yard runoff and other wastewater

Nearest Downstream Town : Name Granger, WY

Distance from the impoundment Approx. 55 miles

Impoundment Location:

Longitude 109 Degrees 58 Minutes 08 Seconds

Latitude 41 Degrees 35 Minutes 29 Seconds

State WY County Sweetwater

Does a state agency regulate this impoundment? YES X NO ______

If So Which State Agency? WY Department of Environmental Quality, Division of Water

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

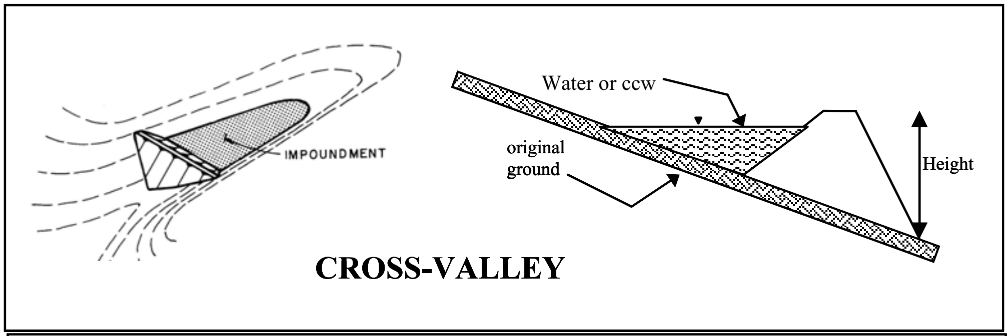
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

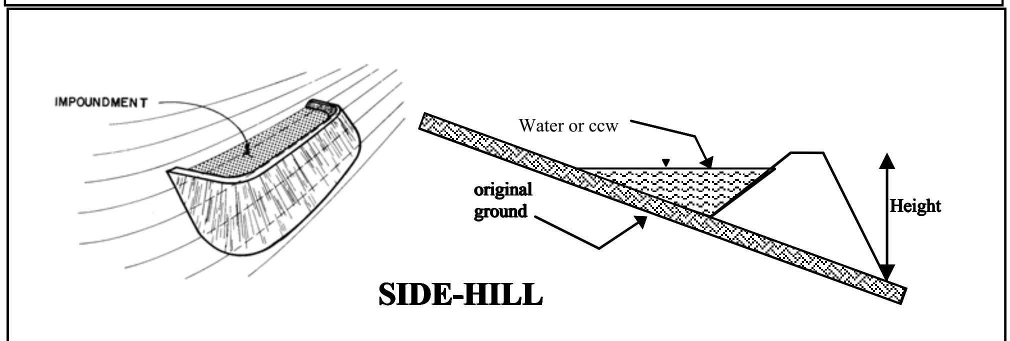
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Breach of the South Ash Pond Dike could result in a release of coal combustion by-product to adjacent properties.

CONFIGURATION:

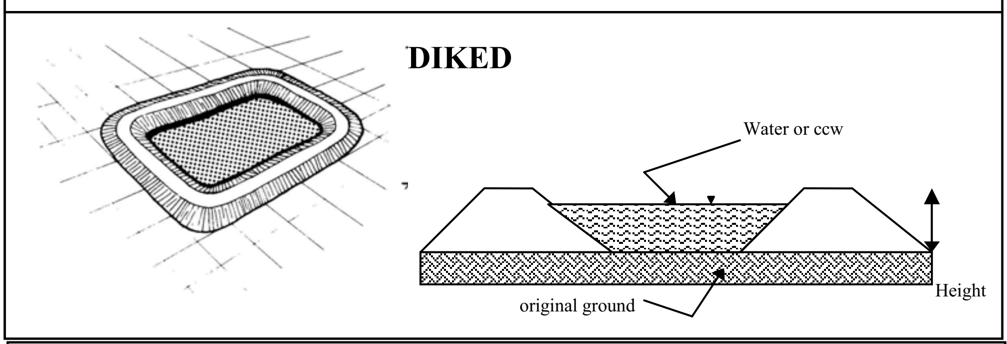


CROSS-VALLEY

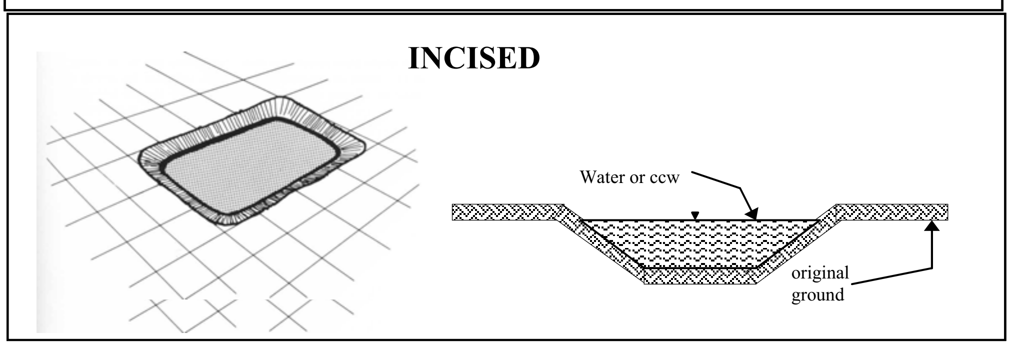


SIDE-HILL

DIKED



INCISED



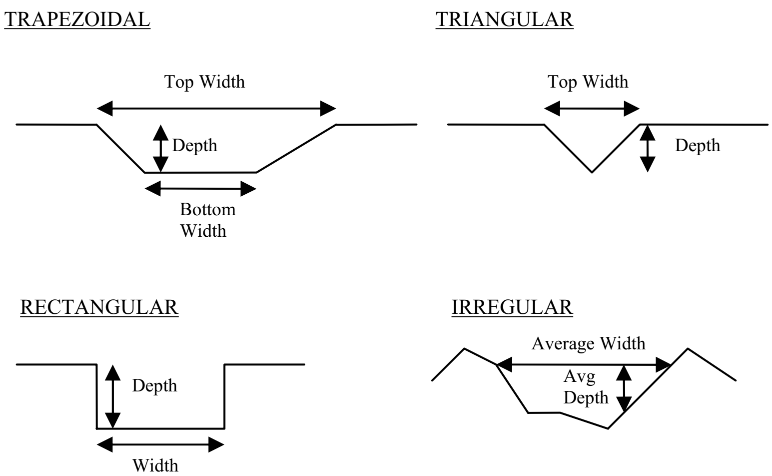
______ Cross-Valley
__X__ Side-Hill
______ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

Embankment Height __71__ feet   Embankment Material __Compacted clay__
Pool Area __206__ acres   Liner __None__
Current Freeboard __5__ feet   Liner Permeability __None__

TYPE OF OUTLET (Mark all that apply)

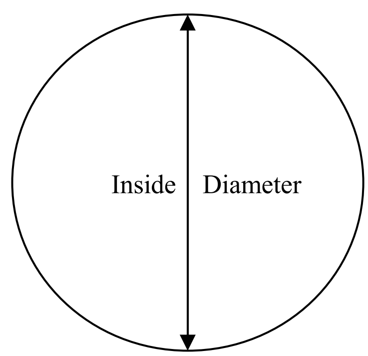
______ **Open Channel Spillway**
______ Trapezoidal
______ Triangular
______ Rectangular
______ Irregular

______ depth
______ bottom (or average) width
______ top width



__X__ **Outlet**

______ inside diameter



Material
______ corrugated metal
______ welded steel
______ concrete
______ plastic (hdpe, pvc, etc.)
______ other (specify) ______________________

__X__ Unknown

Is water flowing through the outlet? YES __X__ NO ______

______ **No Outlet**

______ **Other Type of Outlet** (specify) ______________________

The Impoundment was Designed By Black & Veatch

Has there ever been a failure at this site? YES __________ NO ____X____

If So When? ___________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES _______ NO ___X___

If So When? ____________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower
Phreatic water table levels based on past seepages or breaches
at this site? YES ________ NO ___X___

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____